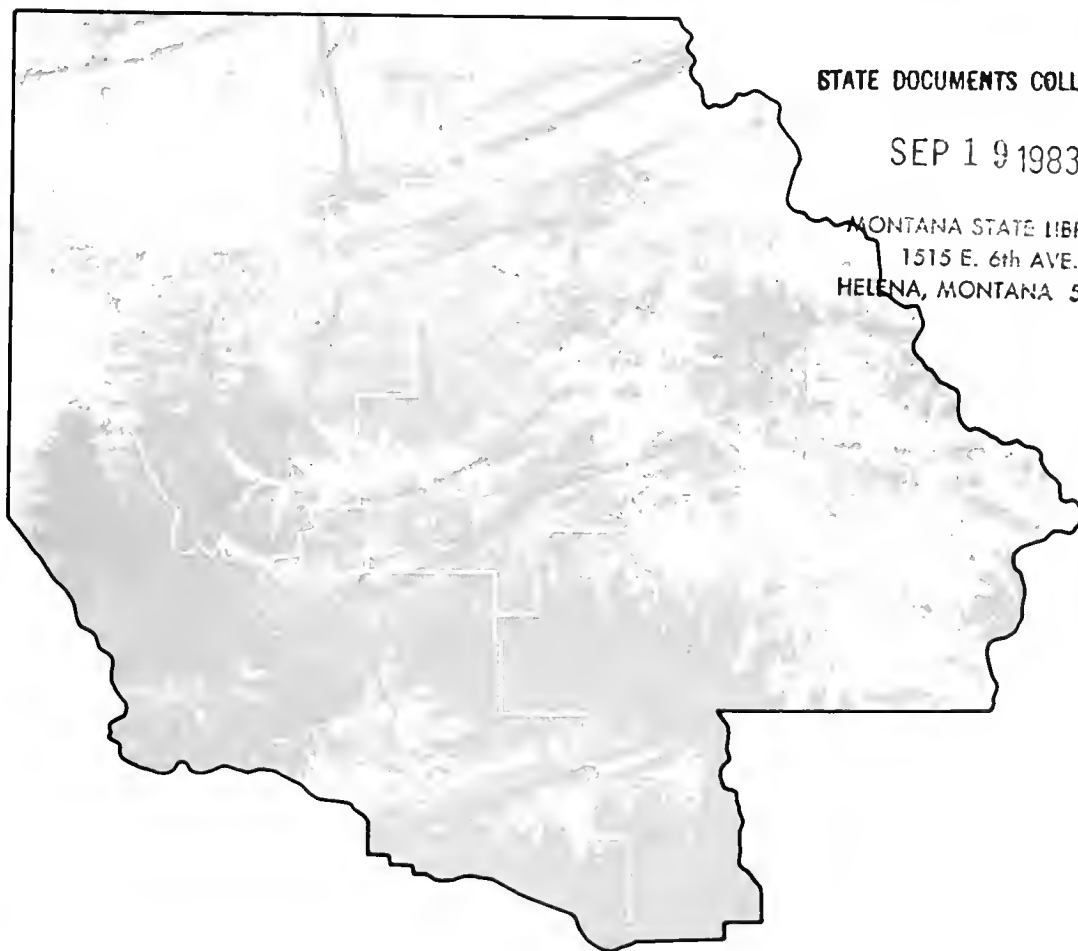


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DECEMBER 1982

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ABSTRACT

Timber inventory data collected for the 1.6 million acres of state and private commercial timberlands in Working Circle 1, which includes Flathead, Lake, Lincoln, and Sanders counties, estimate a total growing stock volume of 2.8 billion net cubic feet. Sawtimber volume was estimated at 8.7 billion net board feet Scribner. Approximately 1.2 million acres of grazable timberland, of which 1.0 million acres are in good or excellent condition, exists on state and private lands within the working circle. In 1977 the carrying capacity of this acreage was 193,000 animal unit months.

The area surveyed was found to be very favorable for timber production. In fact, Working Circle 1 has the highest potential productivity of any working circle in the state. An average commercial timberland acre within this working circle has the potential to produce 79 cubic feet of wood per year. Based on a timberland quality class analysis, 75 percent of the softwood commercial timberlands in Working Circle 1 are rated as excellent or good for producing timber.

Many acres of land in the working circle are in lower stand volume classes. About 53 percent of the commercial timberlands contain less than 5,000 board feet Scribner of timber per acre. Stands that contain more than 10,000 board feet Scribner per acre represent only 22 percent of the total commercial forest. About 54 percent of the softwood growing stock cubic foot volume is comprised of trees less than 13.0 inches in diameter at breast height (d.b.h.).

It may not be possible to continue the current rate of harvesting on private land indefinitely under the existing level of timber management. The data also show that forest condition could be improved and timber production increased on about 70 percent (1.1 million acres) of the softwood commercial timberlands in the working circle. Silvicultural treatment opportunities other than harvesting could be applied to 52 percent of these lands. The amount of timber available for harvest in the future depends on how intensively these timberlands are managed now.

ABBREVIATIONS

AUM	animal unit month
BAF	basal area factor
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CFL	Commercial forest land d.b.h. (diameter at breast height)
DNRC	Montana Department of Natural Resources and Conservation
DSL	Montana Department of State Lands
MAI	mean annual increment
MBF	thousand board feet
MBFS	thousand board feet Scribner
MMBF	million board feet
NCFL	noncommercial forest land
NPS	National Park Service
SCS	Soil Conservation Service
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service

PREFACE

This report, which summarizes the findings of a timber resource inventory conducted in Flathead, Lake, Lincoln, and Sanders counties (Working Circle 1), is the second in a series of reports discussing forest inventories in Montana. Each report will display and analyze inventory data for a different portion of the state. A statewide report subsequently will be published by the Intermountain Forest and Range Experiment Station in cooperation with the Montana Department of State Lands (DSL), Forestry Division.

The inventory of Working Circle 1 began in November 1976 under the authority of an existing cooperative agreement between the Intermountain Forest and Range Experiment Station, Region 1 of the USDA Forest Service, and the Montana Department of Natural Resources and Conservation, Forestry Division. Under the agreement, the Forestry Division, transferred to DSL in 1981, would supervise the collection

of forest inventory data on all lands in Working Circle 1, except those administered by the USDA Forest Service or the USDI Bureau of Indian Affairs or Bureau of Land Management. Glacier National Park also was to be excluded from the inventory. The USDA Forest Service would provide technical assistance and 60 percent of the funding for the project. The state of Montana would provide the remaining 40 percent.

Aerial photo interpretation began in January 1977 and was concluded in May of that year. Field data collection from 560 forested plots began immediately and continued until the last plot was measured in November 1977.

Readers should note that because the data were rounded off to reach the numbers used in this report, the column and row totals in some tables may not be the exact sum of the individual cells.

GEOGRAPHICAL FEATURES of WORKING CIRCLE 1

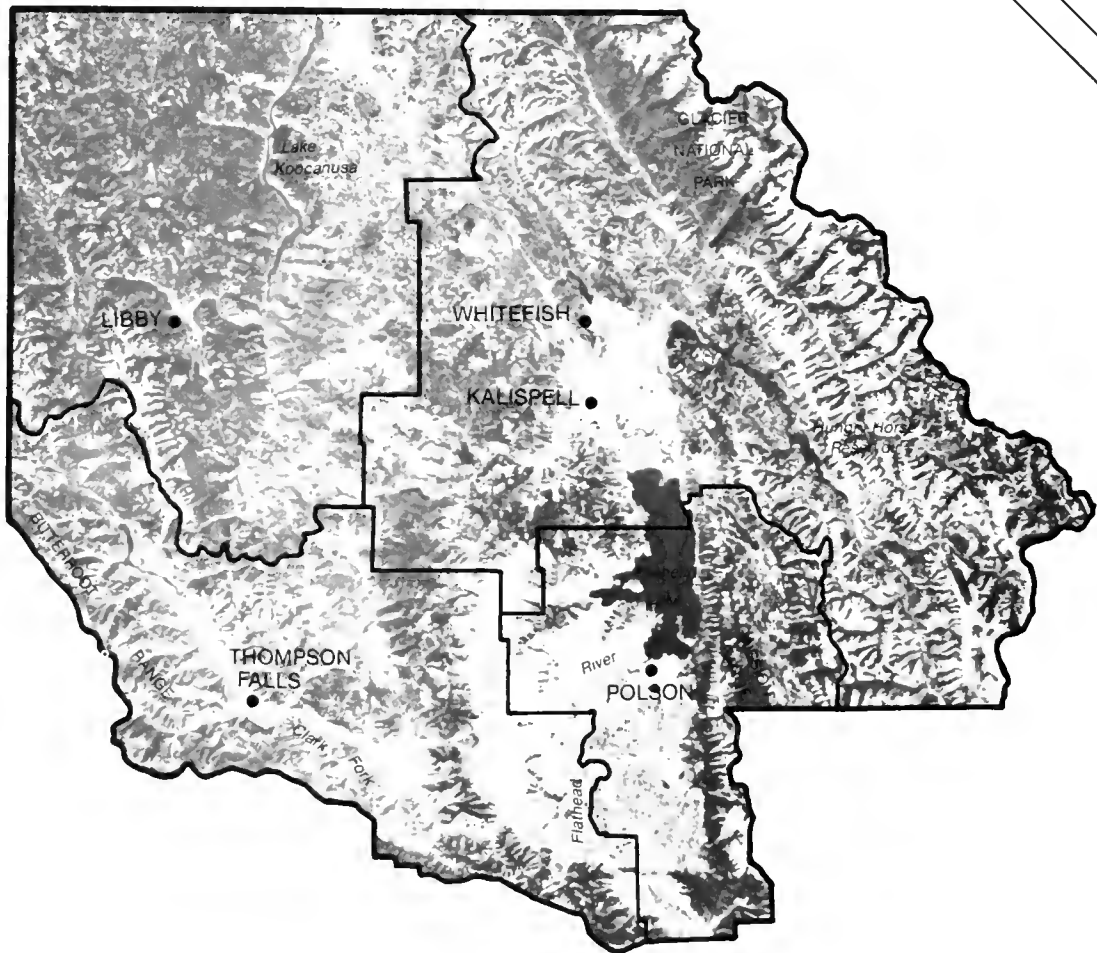


FIGURE 1

INTRODUCTION

GEOGRAPHICAL OVERVIEW

Working Circle 1 (see figure 1), composed of four counties in the northwestern corner of Montana, has a higher potential forest productivity than any other working circle and is the major producer of timber from private lands in the state. The area's potentially high productivity stems from its relatively low overall elevation and the high amount of precipitation it receives from moist Pacific weather systems. All of the working circle is west of the Continental Divide, which represents most of its eastern boundary. Several mountain ranges are in the working circle, as are some wilderness areas and wildlife refuges. The most popular tourist areas are Glacier National Park and Flathead Lake. Elevations range from 10,142 feet on Mount Stimpson in the park to 1,820 feet where the Kootenai River flows into Idaho. Total land area for the four counties is almost 8.4 million acres, or about the same area covered by the states of Connecticut and Massachusetts combined. More than 2.5 million acres, or about 30 percent of the total land area in the working circle, were sampled. Of these acres, 62 percent are forested.

Flathead County

Flathead County, which covers 3,287,616 acres, is the third largest county in the state. A fifth of the county's 51,462 residents live in Kalispell, the county seat. The terrain ranges from the rolling lowlands of the Flathead River valley to the extremely rugged mountains of Glacier National Park. The eastern border follows the Continental Divide from Canada into the Bob Marshall Wilderness. The southwestern border extends into the Flathead Indian Reservation and the north end of Flathead Lake. Seventy percent of the

841,071 acres sampled in the county are forested.

Flathead County rivals Lincoln County as the state's leading producer of timber from private land; in this role, it actually surpassed its western neighbor from 1973 to 1975. At the time of this inventory, eight major sawmills in Flathead County produced between 200 and 250 million board feet (MMBF) of lumber annually. Thirty-nine small sawmills produced another 10 MMBF annually. Two plywood mills had an annual output of between 300 and 350 million square feet*, while one fiber board plant produced just over 110 million square feet** per year. Eight post and pole processors and one cedar mill also operated in the county (see appendix 2). Flathead County also produces more plantation-grown Christmas trees than any other county in Montana.

Lake County

Lake County is bordered by the Mission Mountains on the southeast and by the Swan Mountains on the northeast. Most of Flathead Lake, the largest fresh-water lake west of the Mississippi River, lies in Lake County. The lake is drained by the Flathead River, which flows south to the Clark Fork and forms a portion of the Sanders County border on the west. Part of the National Bison Range is in Lake County, as are Ninepipe and Pablo national wildlife refuges. Nearly half of the Flathead Indian Reservation lies in Lake County, while most of the county is within the reservation boundary.

Despite the fact that some of Montana's most productive timberland is in Lake County, it is not one of the major producers of timber from private lands. The county's two largest sawmills produce 80

*on a 3/8" basis
**on a 3/4" basis

MMBF of lumber annually (see appendix 2). Of the 507,201 acres sampled in Lake County, about 35 percent are forested. Polson, the largest town in Lake County and the county seat, is home for 15 percent of Lake County's 19,098 residents.

Lincoln County

Lincoln County produces more timber from private lands than any other county in the state. Except for a small area to the east, all of Lincoln County is drained by the Kootenai River. Lake Koocanusa, a reservoir formed by the Libby Dam, enters from Canada and runs south to the dam, about 15 miles east of Libby. The river crosses the border into Idaho at the lowest point in Montana (elevation 1,820 feet). The Cabinet Mountains border Lincoln County to the south, while the Whitefish Range and the Salish Mountains lie to the east. Lincoln County has a population of 17,731; almost a sixth of these residents live in Libby, the county seat.

Three major sawmills in Lincoln County produce between 200 and 250 MMBF of lumber per year. Twenty-nine small sawmills yield another 7 MMBF of lumber annually. The only plywood plant in the county produces approximately 75 million square feet* per year. Seven cedar mills and one post and pole plant also operate in the county (see appendix 2). Lincoln County shows the highest percentage of forested land in the working circle--almost 85 percent of the 585,988 acres sampled are forested.

Sanders County

The northern part of Sanders County is bordered by the Cabinet Mountains on the east and the Bitterroot Range and Idaho on the west. The Coeur d'Alene Mountains and the Reservation Divide to the south form the border with Mineral and Missoula counties. The Flathead River forms part of the border with Lake County, then turns east to flow into the Clark Fork River near Paradise. Eastern Sanders County extends into the Flathead Indian Reservation and the National Bison Range.

Sanders County is one of Montana's most important producers of timber from private lands. Fourteen small sawmills, two post and pole producers, and three major sawmills, which annually produce 97 MMBF of lumber, operate within the county (see appendix 2). Sanders county, with a population of 8,559 is the least populous county in the working circle. About 17 percent of its residents live in the county seat, Thompson Falls. Of the 638,387 acres of land sampled in Sanders County, 54 percent are forested.

FOREST TYPES

A description of each forest type occurring in Working Circle 1 follows. These descriptions may not be the same for all working circles in the state.

Because more than one tree species can occur within a given forest type, those species that exhibited the largest number of live trees (plurality of stocking) at a sampled location determined the forest type. Individual trees were ranked according to their relative dominance in the plot. In those cases where trees had overstocked a site, smaller or less dominant trees were not counted. Thus, they did not play a part in determining the forest type. Unless a stand of trees is lightly stocked with poletimber or sawtimber, seedlings and saplings seldom are considered when designating a forest type.

Working Circle 1 contains many of the Pacific Coast forest species less common or absent elsewhere in the state. These species, which include western hemlock, mountain hemlock, western redcedar, grand fir, western white pine, and western yew (*Taxus brevifolia*), receive the abundant precipitation and comparatively moderate temperatures they need to survive from moist maritime airmasses that pass over the area on their way inland from the Pacific Coast (Arno 1979).

This climate, likewise, is largely responsible for the complexity of the forest types found in the working circle. Working Circle 1 shows more variability in its forest types than other areas of the state; on some sites it is common to find five or six different species of conifers growing in the same stand.

*on a 3/8" basis



Douglas-fir type

The Douglas-fir forest type covers more acres and contains more timber than any other forest type sampled in Working Circle 1. This type occurs over a wide range of elevations, from as low as 2,000 feet in Lincoln County to over 6,000 feet elsewhere in the working circle, and on all aspects. Ponderosa pine (*Pinus ponderosa* var. *ponderosa*), lodgepole pine (*Pinus contorta* var. *latifolia*), and western larch (*Larix occidentalis*) are seral species commonly found growing with Douglas-fir (*Pseudotsuga menziesii* var. *glauca*). In areas where Douglas-fir is not the climax species, seral stands of Douglas-fir can be found on grand fir (*Abies grandis*), subalpine fir (*Abies lasiocarpa*), western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), and spruce (*Picea* species) sites.

Lodgepole pine type

The lodgepole pine forest type was the second most prevalent type sampled in Working Circle 1. Stands of lodgepole pine, typically homogeneous, can be found growing almost anywhere, except within certain timberline whitebark pine habitat types, ponderosa pine habitat types, and the warmer, drier Douglas-fir habitat types. Stands of lodgepole pine were sampled at elevations from 2,400 feet to well over 6,000 feet.

Generally, the presence and abundance of lodgepole pine reflects the fire history of the area. After a fire or certain harvesting practices, this species will often regenerate into dense stands, which tend to stagnate.



Ponderosa pine type

The ponderosa pine forest type was found at elevations between 2,000 and 5,000 feet. Productivity of ponderosa pine stands ranged from less than 20 cubic feet per acre per year (noncommercial timberland) to some of the highest levels sampled in the working circle. Nearly pure stands are most often found on sites where ponderosa pine is the climax species or on the warmer, well-drained Douglas-fir climax sites. Other tree species associated with the ponderosa pine forest type were Douglas-fir, western larch, lodgepole pine, and grand fir.



Western larch type

The western larch forest type was sampled at elevations from 2,000 to 5,300 feet. The presence of western larch, like lodgepole pine, reflects the fire history of the area. Western larch is the least shade-tolerant commercial tree species inhabiting the northern Rockies (Schmidt et al. 1976). To regenerate harvested larch stands, even-aged management techniques, including the clearcutting, shelterwood, and seed-tree methods, are used to create conditions similar to those that follow wildfires.

Western larch always occurs as a seral component of the forest and can be found growing over a wide range of ecological conditions. All commercial softwood tree species found in northwestern Montana, except whitebark pine (*Pinus albicaulis*), were found in varying amounts within this forest type.

Subalpine fir - Spruce type

Commercial stands of the subalpine fir-spruce forest type were sampled at elevations from just over 3,000 feet to just below 7,000 feet. In northwestern Montana, many tree species can be found growing within the subalpine fir-spruce forest type. Of the commercial softwood species found in the working circle, only ponderosa pine and western hemlock were not sampled as a component of this forest type. On the drier more exposed sites, stands classified as subalpine fir-spruce may contain very few if any spruce trees. Subalpine fir is the most common species in this forest type.

Stands of this type tend to be unevenly aged and heavily stocked under natural conditions. Subalpine fir is highly shade tolerant and grows in cold, moist climates. Often a slow growing species, subalpine fir is susceptible to fire, wind damage, and heart rot. Consequently, individual trees of this species rarely live longer than 250 years. Due to its susceptibility to heart rot and the brittle nature of its wood, subalpine fir is not a preferred timber species.



Grand fir type

The grand fir forest type is commonly found on cool, moist sites that are too temperate to be dominated by subalpine fir. Stands of this type were sampled at elevations from 2,200 to 4,500 feet. However, stands may be found up to 5,000 feet in this working circle (Pfister et al. 1977). Grand fir, like other shade-tolerant trees, can be found growing with many other tree species. Of the commercial softwood tree species occurring in this working circle, only whitebark pine was not found to be a component of the grand fir forest type; Douglas-fir occurs most often.

Grand fir stands occupy some of the most productive forest lands in the state. Seventy-five percent of the land occupied by the grand fir forest type is estimated to be able to produce at least 85 cubic feet of wood per acre per year. Grand fir stands tend to be uneven-aged and well stocked when undisturbed. The common presence of heart rot diseases—principally Indian paint fungus (*Enchyodontium tinctorium*)—has diminished the species' value as a timber producer (USDA Forest Service Handbook #271), although the species may become important if it is harvested on a shorter rotation schedule.



Spruce type

The spruce forest type was found in moist to wet areas with cool to cold climates. Spruce (*Picea* sp.) is commonly found growing in cool ravines, along streams and lakes, or in areas with a high water table. It also can be found growing at or near timberline in association with whitebark pine and subalpine fir. Other tree species most often found growing with spruce were western larch, Douglas-fir, lodgepole pine, and cottonwood (*Populus trichocarpa*). Stands of this type were sampled at elevations from just under 3,000 feet to 6,000 feet.

In Montana, the most common species of spruce is Engelmann spruce (*Picea engelmannii*), although in many stands Engelmann spruce has hybridized with white spruce (*Picea glauca*). Occasionally, a stand containing white spruce can be found (Pfister et al. 1977).



Western redcedar type

Stands of western redcedar are generally confined to bottomlands and northerly exposures between 2,000 and 5,000 feet on sites where annual precipitation is 32 inches or more (Pfister et al. 1977). Although this forest type is most common in the Libby-Troy area, it can also be found in the Swan Valley and other scattered locations throughout the working circle. Stands were sampled at elevations from 2,400 to 4,400 feet.

Western redcedar is very shade tolerant; of the timber species in Montana, only western hemlock and subalpine fir are more shade tolerant (Baker 1950). Younger stands often contain heavy amounts of undergrowth. However, old growth stands can create such a dense canopy that little vegetation grows on the forest floor. A valuable timber species, redcedar is used primarily for shakes, shingles, and siding. Because heart rot often afflicts mature trees, however, the amount of usable wood produced by these trees is limited.

The most productive timberlands in the state are occupied by the western redcedar or western hemlock forest types and/or habitat types. Only 27,000 acres of timberland were classified as the western redcedar forest type, although 106,000 acres were classified as being in the western redcedar climax series.

Western white pine type

Western white pine (*Pinus monticola*) can grow at elevations from 2,000 to 6,000 feet (Pfister 1977, USFS 1965). The western white pine forest type was sampled at an elevation of 2,400 feet. Due to limiting factors—forest fires, white pine blister rust (*Cronartium ribicola*), and logging—this forest type is not very common in Montana. Nevertheless, western white pine was sampled as a component of several stands throughout the working circle.

Western white pine is more shade tolerant than Douglas-fir but less shade tolerant than grand fir (Baker 1950). Because western white pine always grows in association with more shade-tolerant species, it is always a seral component of the forest (Pfister 1977).

The high quality of the tree's wood and its growth characteristics (tall, straight boles and small limbs) make western white pine a valuable timber species. Unfortunately, its principal enemy, white pine blister rust, has created serious management problems for anyone wishing to regenerate stands of this species and has limited its distribution.



Western hemlock type

The western hemlock forest type can be found in moist areas within the maritime-influence climatic zone of northwestern Montana. Hemlock grows in the same habitats as western redcedar, although redcedar will extend locally onto slightly drier sites (Pfister 1977). Hemlock is most commonly found in the Kootenai River drainage and in the lower Clark Fork River drainage northwest of Thompson Falls. The range of this forest type appears to be limited in the upper Flathead Valley by the cold masses of arctic air that frequently sweep through the eastern half of the working circle (Arno 1979). Because sustained periods of cold weather can damage hemlock and redcedar, these species have survived only where temperatures are moderated by the presence of a large body of water or where sheltered valley ravines produce a suitable microclimate.

Western hemlock is very shade tolerant; in fact, it is the most shade tolerant tree that grows naturally in the state (Baker 1950). In Oregon and Washington western hemlock is an important timber species. In Montana, however, the high incidence of heart rot, primarily Echinodontium tinctorium, in merchantable-sized trees has precluded its use as a major timber species (USFS 1965).

Forest lands in Montana occupied by the western hemlock forest type or classified as being within the western hemlock climax series exhibit the highest potential for producing timber. About 145,000 acres of state and private forest lands in Working Circle 1 are in the western hemlock climax series.



Whitebark pine type

The whitebark pine forest type occurs at the upper limits of commercial forest land; commercial stands were sampled at elevations from 6,200 to 6,800 feet. Commonly associated species are subalpine fir, spruce, mountain hemlock (Tsuga mertensiana) and, occasionally, lodgepole pine. This type is often found above or adjacent to the subalpine fir-spruce forest type, on sites too harsh or exposed for subalpine fir to dominate.

Whitebark pine grows slowly and can live for many years. Trees 400 to 500 years old are not uncommon. Whitebark pine is not an important commercial species in Working Circle 1.



Juniper type

The juniper forest type grows on dry, rocky sites at a wide range of elevations. Stands were sampled at elevations ranging from 3,000 to 6,000 feet. Most of the juniper stands sampled were not found on sites capable of producing 20 cubic feet per acre per year under natural conditions. Commercial stands of juniper (Juniperus scopulorum) often contain Douglas-fir and/or ponderosa pine. In some parts of the state, juniper is used for fence posts and firewood. The volume shown for this forest type or any other forest type does not include juniper because it is not considered a commercial species in Montana.

Aspen type

In Working Circle 1, aspen (Populus tremuloides) stands are usually small and occur adjacent to or among conifer stands. Aspen stands were sampled at elevations ranging from 2,700 to 3,500 feet. Cottonwood was the species most commonly associated with aspen.

Periodic wildfires seem necessary for aspen stands to perpetuate (Pfister 1977). In areas where wildfires have successfully been suppressed, aspen stands seem to be succeeding towards conifer stands.

Aspen is not an important commercial species in Working Circle 1.



Cottonwood type

Stands of cottonwood grow along rivers and streams throughout the working circle. Most of these stands occur in the Flathead River valley near Kalispell. Cottonwood trees also can be found growing alone or in small clusters within conifer stands. This condition is most common on sites in the western redcedar, western hemlock, spruce, and grand fir climax series.

Cottonwood, like aspen, is not an important commercial timber species in Working Circle 1.



Mixed hardwoods type

The mixed hardwood forest type is composed of stands that are predominately birch (*Betula papyrifera* or, possibly, *Betula occidentalis*) or alder (*Alnus tenuifolia*). The type commonly occurs in moist areas and along rivers and streams. Stands of this type were sampled at elevations ranging from 3,200 to 3,600 feet. Tree species commonly associated with this type are cottonwood, aspen, spruce, lodgepole pine, and larch.

The mixed hardwood type is not commercially important in Working Circle 1.

INVENTORY PROCEDURES

The timber resource inventory was designed to provide inventory data for the individual working circles in Montana and the state as a whole. Because reliable county data was desired in Working Circle 1, a large number of field plots were sampled. This allowed the data to be stratified further to provide better information at the county level.

Forest inventory data were collected on all private, state, county, municipal, and some miscellaneous federal lands in the working circle. These federal lands included USDI Fish and Wildlife Service lands, lands within national monuments, such as the National Bison Range at Moiese, and other lands controlled by the U.S. Army Corps of Engineers and the USDI Bureau of Reclamation. The sampled area, which totalled 2.6 million acres, included forested and nonforested lands. (NOTE: TIMBER RESOURCES ON USDA FOREST SERVICE, USDI BUREAU OF INDIAN AFFAIRS, USDI BUREAU OF LAND MANAGEMENT, AND NATIONAL PARK SERVICE LANDS WERE NOT INVENTORIED.)

Sample points were selected, measurements taken, and data analyzed through the following methods:

1. Initial area estimates were based on the classification of 20,985 sample points systematically placed on the latest aerial photographs available. The dates of these photos ranged from 1971 to

1974; most were 1972 photos. The sample points were summarized and grouped into strata for subsequent field sampling. The photo points, adjusted to meet known land areas, were used to compute area expansion factors for the field stratum means.

2. Land classification and estimates of timber characteristics and volume were based on observations and measurements recorded at 701 ground sample locations. Sample trees were selected using a 10-point cluster that included fixed plots (1/300 acre) for trees less than 5.0 inches in d.b.h. and variable plots (40 BAF) for trees 5.0 inches d.b.h. or larger.

3. All photo and field data were sent to the Intermountain Experiment Station in Ogden, Utah, to be punched onto computer cards and stored for machine computing, sorting, and tabulation. Computerized edits were sent to the inventory crew for corrections. Final estimates were based on statistical summaries of the data. Data reliability are listed in appendix 6.

In the tables and figures that follow, all measurements in board feet denote board-feet Scribner, unless otherwise noted. Also, all timber volume estimates were based on standing live timber unless otherwise noted--standing dead timber was not included in volume estimates.

MAJOR INVENTORY FINDINGS

AREA BY OWNERSHIP GROUP

Table 1 shows the amounts of land in Working Circle 1 owned or administered by different groups or individuals. As this table shows, public agencies own or administer 74 percent of the land. The USFS administers the largest portion of this public land, as well as most of the forested land in the working circle.

The proportion of the sampled lands--private, state, county, municipal, and miscellaneous federal--owned or administered by different ownership groups is

shown in figure 2. Each ownership group represents one or more ownership classes. The amounts of land owned or administered by these different classes are shown in table 2. Definitions for ownership groups and classes are in the glossary.

Of the commercial timberlands sampled, about 52 percent, or 819,000 acres, are owned by forest industries (see table 3). Another 24 percent is owned by other private corporations or individuals (see figure 3). All private land holdings 40 acres or less in size were considered to be in the other private individual ownership class (see table 2).

TABLE 1.
Total land area by owner,
Working Circle 1 (acres).

Owner	Acreage	Percentage of Total
<hr/>		
Public:		
Glacier National Park	643,103	7.7
USDI Bureau of Indian Affairs	522,059	6.2
USDA Forest Service	4,632,189	55.3
Miscellaneous federal	23,004	0.3
State	338,329	4.1
County and municipal	2,270	*
Subtotal	6,160,954	73.6
Private:		
Forest industry	889,036	10.6
Other private	1,320,008	15.8
Subtotal	2,209,044	26.4
TOTAL	8,369,998	100.0

*Indicates less than 0.05 percent.

FIGURE 2. Proportion of the total sampled area (forest and nonforest) by ownership group.

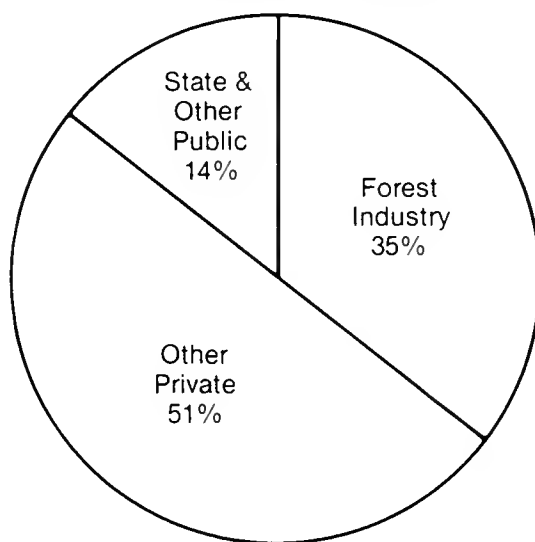


TABLE 2.
Area of commercial and other timberland
by owner, Working Circle 1 (thousand acres).

Owner	Commercial Timberland	Other Timberland	All Timberland	Percentage of Total
<hr/>				
thousand acres				
Public:				
State	279.5	3.2	282.7	17.7
Miscellaneous federal	0.5	—	0.5	*
County and municipal	0.8	—	0.8	*
Subtotal	280.8	3.2	284.0	17.8
Private:				
Forest industry	819.4	2.4	821.8	51.5
Farmer-rancher	89.5	3.9	93.4	5.9
Other private corporate	9.9	0.4	10.3	0.6
Other private individual	381.2	3.9	385.1	24.2
Subtotal	1,300.0	10.6	1,310.6	82.2
TOTAL	1,580.8	13.8	1,594.6	100.0

* Indicates less than 0.05 percent.

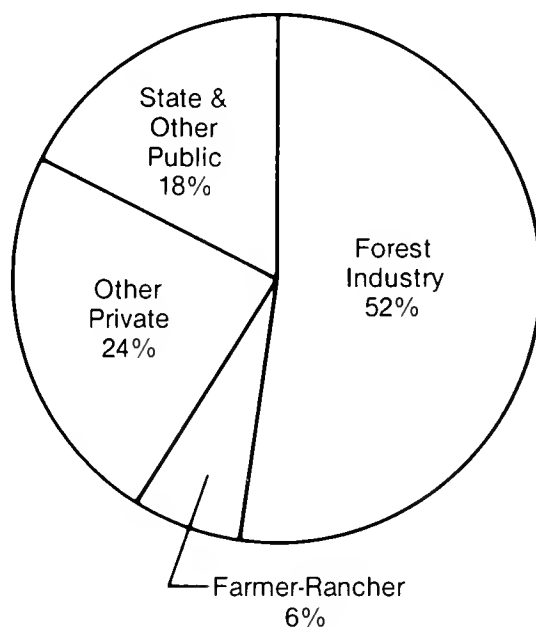
TABLE 3.
Sampled land area by ownership group,
Working Circle 1 (acres).

Land class	Ownership Group			
	State	Forest Industry	Private*	Total
	acres			
Commercial timberland	279,462	819,407	481,884	1,580,753
Productive reserved**	902	400	4,921	6,223
Other forest land:				
Unproductive reserved**	—	—	1,028	1,028
Unproductive nonreserved	3,199	2,392	8,230	13,821
Total forest land	283,563	822,199	496,063	1,601,825
Nonforest land	54,766	66,837	849,219	970,822
TOTAL	338,329	889,036	1,345,282	2,572,647

*The private owner category (in this table only) includes a small portion of miscellaneous federal, county, and municipal ownership.

**The productive and unproductive reserved category includes acres of forest land in the Moiese National Bison Range and the wild and scenic corridor of the North Fork of the Flathead River.

FIGURE 3. Proportion of the sampled commercial forest land area by ownership group, Working Circle 1.



FOREST TYPE ACREAGE

The four most important commercial forest types in Working Circle 1--Douglas-

fir, lodgepole pine, ponderosa pine, and western larch--occur on 82 percent of the commercial forest lands or almost 1.3 million acres (see table 4). Hardwood forest types occur on almost 20,000 acres, or about 1 percent of these lands.

TABLE 4.
Net volume of growing stock on commercial timberland
by forest type and ownership group, Working Circle 1
(thousand cubic feet).

Forest Type	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	thousand cubic feet				
Douglas-fir	223,948	656,329	268,202	1,148,480	41.2
Lodgepole pine	124,656	362,921	137,188	624,765	22.4
Ponderosa pine	15,008	81,479	56,492	152,979	5.5
Western larch	77,049	144,864	110,261	332,174	11.9
Subalpine fir	80,241	42,768	4,151	127,160	4.6
Grand fir	32,532	100,954	12,999	146,484	5.2
Spruce	31,530	57,272	45,752	134,554	4.8
Western redcedar	6,185	58,239	15,501	79,925	2.9
Western hemlock	33	—	5,768	5,801	0.2
Whitebark pine	3,716	15,567	—	19,283	0.7
Western white pine	60	—	4,045	4,104	0.1
Juniper	—	—	314	314	*
Softwood types	594,957	1,520,393	660,671	2,776,022	99.5
Aspen	151	—	9,969	10,120	0.4
Cottonwood	406	428	1,228	2,063	0.1
Mixed hardwoods	10	—	1,701	1,711	*
Hardwood types	568	428	12,898	13,893	0.5
ALL FOREST TYPES	595,525	1,520,821	673,569	2,789,915	100.0

*Indicates less than 0.05 percent.

FOREST TYPE VOLUME BY OWNERSHIP GROUP

Seventy-eight percent of the working circle's total board-foot volume and 81 percent of its total cubic-foot volume are contained within the Douglas-fir, lodgepole pine, ponderosa pine, and

western larch forest types (see tables 5 and 6).

Forest industries own most of the timber volume inventoried--57 percent of the working circle's total board-foot volume and 55 percent of its total cubic-foot volume. Twenty-three percent of the total board-foot volume is on state and other publicly owned lands. The remaining 20 percent is found on other (non-forest industry) private lands.

TABLE 5.
Net volume of sawtimber on commercial timberland by
forest type and ownership group, Working Circle 1
(thousand board feet Scribner).

Forest Type	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	MBFS				
Douglas-fir	793,007	2,359,531	696,815	3,849,352	44.2
Lodgepole pine	237,621	669,436	243,086	1,150,143	13.2
Ponderosa pine	58,141	356,503	193,331	607,976	7.0
Western larch	302,646	559,827	326,215	1,188,688	13.6
Subalpine fir	308,745	152,989	10,632	472,366	5.4
Grand fir	116,873	389,798	25,812	532,483	6.1
Spruce	136,879	208,644	127,441	472,964	5.5
Western redcedar	25,338	224,792	45,594	295,724	3.4
Western hemlock	98	—	17,182	17,281	0.2
Whitebark pine	9,232	70,113	—	79,345	0.9
Western white pine	118	—	8,096	8,214	0.1
Juniper	—	—	728	727	*
Softwood types	1,988,699	4,991,634	1,694,932	8,675,264	99.6
Aspen	485	—	27,687	28,171	0.3
Cottonwood	1,174	1,235	4,214	6,623	0.1
Mixed hardwoods	8	—	1,484	1,492	*
Hardwood types	1,667	1,235	33,385	36,287	0.4
ALL FOREST TYPES	1,990,366	4,992,869	1,728,316	8,711,551	100.0

*Indicates less than 0.05 percent.

TABLE 6.
Area of commercial timberland by forest type and
ownership group, Working Circle 1 (thousand acres).

Forest Type	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	thousand acres				
Douglas-fir	113.4	384.1	228.1	725.6	45.9
Lodgepole pine	52.1	173.7	63.6	289.4	18.3
Ponderosa pine	12.0	67.3	59.5	138.8	8.8
Western larch	32.8	63.5	41.8	138.1	8.7
Subalpine fir	40.3	38.7	13.5	92.5	5.9
Grand fir	14.3	47.8	7.9	70.0	4.4
Spruce	9.8	22.1	25.6	57.5	3.6
Western redcedar	1.6	12.9	12.8	27.3	1.7
Western hemlock	*	4.3	3.8	8.1	0.5
Whitebark pine	3.5	4.3	—	7.8	0.5
Western white pine	0.1	—	4.0	4.1	0.3
Juniper	—	—	1.7	1.7	0.1
Softwood types	279.9	818.7	462.3	1,560.9	98.7
Aspen	0.1	—	7.8	7.9	0.5
Cottonwood	0.7	0.7	6.3	7.7	0.5
Mixed hardwoods	*	—	4.2	4.3	0.3
Hardwood types	0.8	0.7	18.3	19.9	1.3
ALL FOREST TYPES	280.8	819.4	480.6	1,580.8	100.0

*Indicates less than 50 acres.

FOREST TYPE VOLUME BY SPECIES

Ninety-eight to 99 percent of the total volume (both cubic foot and board-foot) of timber in Working Circle 1 is found in softwood timber species (see tables 7 and 8). Of these species, Douglas-fir is the most important; it contains both the largest cubic-foot volume and the largest board-foot volume. Lodgepole pine ranks second in cubic-foot volume. Western larch ranks second in board-foot volume.

Douglas-fir and western larch together equal 57 percent of the working circle's total board-foot volume.

Tables 7 and 8 show the large number of species that can be found in association with a particular forest type. Seven or more species occur within most forest types. However, stands of timber actually containing seven or more species of trees are rarely found. The forest types presented in this table represent many different stands typically consisting of four or less species.

TABLE 7.
Net volume of growing stock on commercial timberland by forest type
and species, Working Circle 1 (thousand cubic feet).

Forest Type	Softwood Species								
	Douglas- fir	Lodgepole pine	Ponderosa pine	Western larch	Subalpine fir	Grand fir	Spruce fir	Western redcedar	Western* hemlock
				thousand cubic feet					
Douglas-fir	709,260	73,143	134,400	162,673	5,647	34,044	20,055	1,446	1,284
Lodgepole pine	43,760	426,669	8,823	88,781	14,988	9,798	12,313	2,371	320
Ponderosa pine	27,102	6,233	111,558	7,899	—	186	—	—	—
Western larch	56,097	38,216	13,977	186,380	5,063	8,780	8,188	2,747	1,991
Subalpine fir	12,446	6,829	—	20,069	41,304	1,014	29,064	1,649	—
Grand fir	27,341	6,085	1,839	13,399	2,844	59,311	6,680	4,588	4,697
Spruce	10,446	11,048	700	19,191	5,278	7,421	69,536	573	—
Western redcedar	4,787	—	930	12,176	347	15,654	3,479	28,480	8,569
Western hemlock	331	695	—	350	392	411	440	—	3,183
Whitebark pine	—	86	—	—	1,779	—	514	—	860
Western white pine	—	1,498	—	—	—	—	—	—	—
Juniper	86	—	228	—	—	—	—	—	—
Softwood types	891,655	570,502	272,455	510,919	77,642	136,618	150,269	41,854	20,904
Aspen	—	—	661	—	—	—	—	—	—
Cottonwood	—	—	—	—	202	—	370	83	—
Mixed hardwoods	—	1,215	—	—	—	—	—	—	—
Hardwood types	—	1,215	661	—	202	—	370	83	—
ALL FOREST TYPES	891,655	571,717	273,116	510,919	77,843	136,618	150,639	41,937	20,904

*The western hemlock (Tsuga heterophylla) category also includes a small amount of mountain hemlock (Tsuga mertensiana).

TABLE 7. (cont'd.)

Forest Type	Hardwood Species					thousand cubic feet			
	Whitebark pine	Western white pine	Total Softwood Species	Aspen	Cottonwood	Other Hardwoods	Total Hardwood Species	Total	All Species
Douglas-fir	—	1,829	1,143,780	1,630	413	2,656	4,700	1,148,480	
Lodgepole pine	847	1,773	610,441	10,798	2,873	654	14,324	624,765	
Ponderosa pine	—	—	152,979	—	—	—	—	152,979	
Western larch	—	3,488	324,927	—	1,428	5,819	7,247	332,174	
Subalpine fir	7,735	5,917	126,026	—	1,133	—	1,133	127,160	
Grand fir	—	16,056	142,839	—	1,746	1,899	3,645	146,484	
Spruce	—	779	124,972	—	5,592	3,990	9,582	134,554	
Western redcedar	—	3,652	78,074	495	1,223	132	1,851	79,925	
Western hemlock	—	—	5,801	—	—	—	—	5,801	
Whitebark pine	16,043	—	19,283	—	—	—	—	19,283	
Western white pine	—	812	2,310	—	—	1,793	1,793	4,104	
Juniper	—	—	314	—	—	—	—	314	
Softwood types	24,625	34,304	2,731,746	12,923	14,409	16,943	44,275	2,776,022	
Aspen	—	839	1,500	6,465	2,154	—	8,620	10,120	
Cottonwood	—	—	655	—	1,103	305	1,408	2,063	
Mixed hardwoods	—	—	1,215	259	—	236	496	1,711	
Hardwood types	—	839	3,371	6,725	3,257	541	10,523	13,893	
ALL FOREST TYPES	24,625	35,144	2,735,117	19,648	17,666	17,485	54,798	2,789,915	

TABLE 8.
Net volume of sawtimber on commercial timberland by forest type
and species, Working Circle 1 (thousand board feet Scribner).

Forest Type	Softwood Species						
	Douglas- fir	Lodgepole pine	Ponderosa pine	Western larch	Subalpine fir	Grand fir	Spruce
				thousand board feet			Western redcedar
							hemlock
Douglas fir	2,253,305	128,456	622,210	667,397	7,872	98,031	54,538
Lodgepole pine	135,951	520,367	39,232	338,945	25,587	21,296	41,994
Ponderosa pine	78,487	12,261	484,704	31,658	—	866	—
Western larch	183,973	98,488	72,216	746,311	9,463	22,477	21,293
Subalpine fir	47,787	22,990	—	98,570	103,024	2,557	121,800
Grand fir	107,923	12,425	9,975	65,996	4,700	199,065	24,408
Spruce	44,824	31,681	3,497	86,586	11,188	28,079	240,791
Western redcedar	20,064	—	4,015	54,605	1,415	63,777	16,394
Western hemlock	1,228	914	—	1,550	1,711	1,709	2,016
Whitebark pine	—	231	—	—	2,211	—	2,093
Western white pine	—	4,528	—	—	—	—	—
Juniper	—	—	728	—	—	—	—
Softwood types	2,873,542	832,341	1,236,576	2,091,619	167,172	437,856	525,327
							130,487
Aspen	—	—	2,204	—	—	—	—
Cottonwood	—	—	—	—	—	—	1,530
Mixed hardwoods	—	1,492	—	—	—	—	—
Hardwood types	—	1,492	2,204	—	—	—	1,530
ALL FOREST TYPES	2,873,542	833,833	1,238,781	2,091,619	167,172	437,856	526,857
							130,487
							53,494

*The western hemlock (*Tsuga heterophylla*) category also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

Hardwood Species

22

VOLUME BY SPECIES AND OWNERSHIP GROUP

Subalpine fir, grand fir, western hemlock, whitebark pine, and the hardwood species are the least important lumber producing trees in the region. These species represent 12 percent of the total board-foot volume on state and other public lands, 10 percent of the total board-foot volume owned by forest industry, and

8 percent of the total board-foot volume on other private lands.

Douglas-fir, western larch, lodgepole pine, and ponderosa pine contribute most to the cubic-foot and board-foot volumes (see tables 9 and 10, and figures 4 and 5). Other private lands hold most of the hardwood volume. Sixty-four percent of the working circle's total cubic-foot volume and 67 percent of the total board-foot volume of hardwoods are on these lands.

TABLE 9.
Net volume of growing stock on commercial timberland by
species and ownership group, Working Circle 1 (thousand cubic feet).

Species	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	thousand cubic feet				
Douglas-fir	173,640	490,789	227,227	891,656	32.0
Lodgepole pine	123,954	302,966	144,797	571,717	20.5
Ponderosa pine	29,802	174,944	68,370	273,116	9.8
Western larch	116,495	281,585	112,838	510,919	18.3
Subalpine fir	41,575	27,399	8,868	77,842	2.8
Grand fir	23,406	96,598	16,614	136,618	4.9
Spruce	50,196	63,865	36,578	150,640	5.4
Western redcedar	7,526	22,686	11,725	41,936	1.5
Western hemlock*	486	13,346	7,072	20,904	0.7
Whitebark pine	10,446	14,098	81	24,624	0.9
Western white pine	9,653	21,032	4,460	35,145	1.3
Softwood species	587,180	1,509,306	638,631	2,735,117	98.1
Aspen	324	7,152	12,172	19,648	0.7
Cottonwood	2,450	3,502	11,713	17,665	0.6
Other hardwoods	5,571	861	11,053	17,485	0.6
Hardwood species	8,345	11,515	34,938	54,798	1.9
TOTAL	595,525	1,520,821	673,569	2,789,915	100.0

*The western hemlock (*Tsuga heterophylla*) category also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

TABLE 10.

Net volume of sawtimber on commercial timberland by species
and ownership group, Working Circle 1 (thousand board feet Scribner).

Species	Ownership Group			Total	Percentage of total
	State and Other Public	Forest Industry	Other Private		
	thousand board feet				
Douglas-fir	622,230	1,639,510	611,801	2,873,542	33.0
Lodgepole pine	218,710	365,511	249,612	833,833	9.6
Ponderosa pine	126,984	856,714	255,083	1,238,781	14.2
Western larch	522,281	1,236,344	332,994	2,091,619	24.0
Subalpine fir	99,904	55,624	11,645	167,172	1.9
Grand fir	73,226	316,792	47,838	437,856	5.0
Spruce	197,037	240,106	89,714	526,857	6.0
Western redcedar	25,027	73,452	32,008	130,487	1.5
Western hemlock*	869	35,598	17,027	53,494	0.6
Whitebark pine	46,310	66,098	191	112,598	1.3
Western white pine	42,731	89,650	13,002	145,383	1.7
Softwood species	1,975,308	4,975,398	1,660,915	8,611,620	98.8
Aspen	395	8,346	22,660	31,401	0.4
Cottonwood	7,769	9,018	43,090	59,877	0.7
Other hardwoods	6,894	108	1,650	8,652	0.1
Hardwood species	15,058	17,471	67,401	99,931	1.2
TOTAL	1,990,366	4,992,869	1,728,316	8,711,551	100.0

*The western hemlock (*Tsuga heterophylla*) category also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

FIGURE 4. Net volume of softwood growing stock on commercial timberland by species and ownership group, Working Circle 1 (thousand cubic feet).

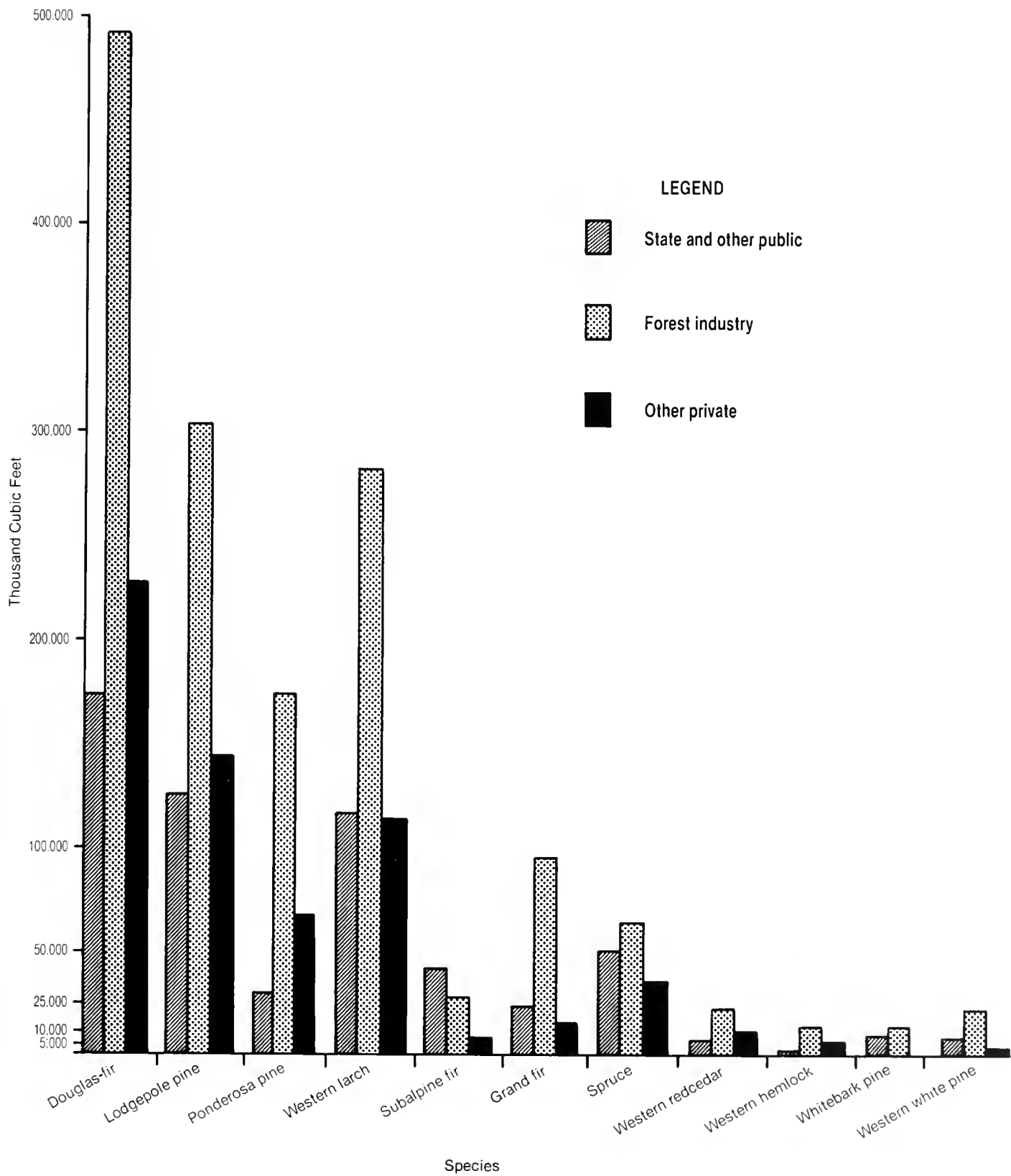
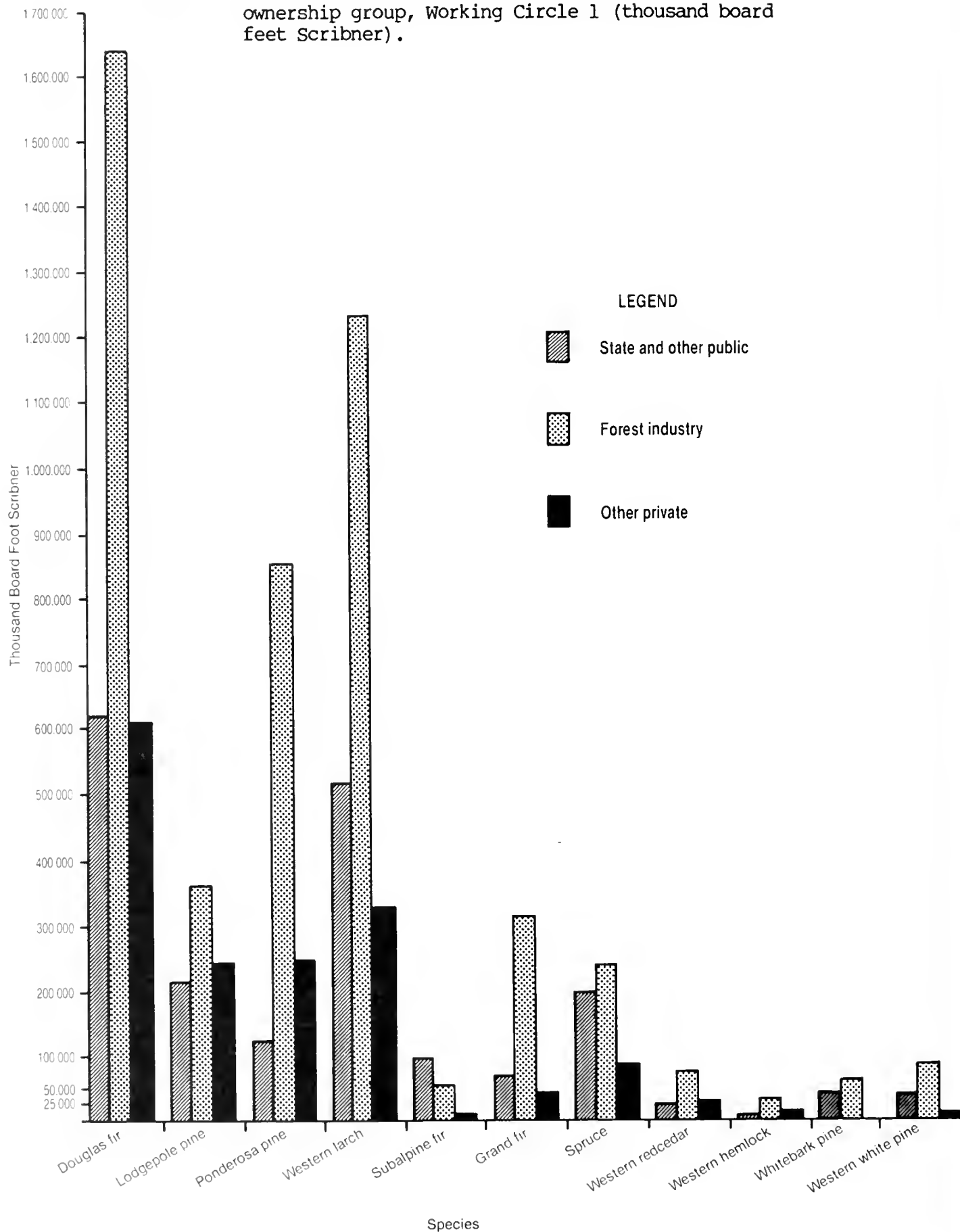


FIGURE 5. Net volume of softwood sawtimber by species and ownership group, Working Circle 1 (thousand board feet Scribner).



VOLUME PER ACRE AVERAGES

An average acre of softwood forest land in Working Circle 1 contains 5,600 board feet Scribner or 1,800 cubic feet of timber. Board-foot volumes measured on field locations ranged from 0 to 38,800 net board feet Scribner per acre.

The highest average board-foot and cubic-foot volumes per acre were measured

on state and other public lands (see tables 11 and 12). Forest industry lands ranked second in average board-foot and cubic-foot volumes, while other private lands ranked third. The average acre of other private forest land contained about half the board-foot volume and about two-thirds the cubic-foot volume found on an average acre of state and other public forest land.

TABLE 11.
Net volume per acre of growing stock on commercial
timberland by forest type and ownership group,
Working Circle 1 (thousand cubic feet per acre).

Forest Type	Ownership Group			
	State and Other Public	Forest Industry	Other Private	All Owners
	—————thousand cubic feet per acre—————			
Douglas-fir	2.0	1.7	1.2	1.6
Lodgepole pine	2.4	2.1	2.2	2.2
Ponderosa pine	1.3	1.2	0.9	1.1
Western larch	2.3	2.3	2.6	2.4
Subalpine fir	2.0	1.1	0.3	1.4
Grand fir	2.3	2.1	1.6	2.1
Spruce	3.2	2.6	1.8	2.3
Western redcedar	3.9	4.5	1.2	2.9**
Western hemlock	*	—	1.5	0.7
Whitebark pine	1.1	3.6	—	2.5
Western white pine	0.6	—	1.0	1.0
Juniper	—	—	0.2	0.2
Softwood types	2.1	1.9	1.4	1.8
Aspen	1.5	—	1.3	1.3
Cottonwood	0.6	0.6	0.2	0.3
Mixed hardwoods	*	—	0.4	0.4
Hardwood types	0.7	0.6	0.7	0.7
ALL FOREST TYPES	2.1	1.9	1.4	1.8

* Indicates numbers too insignificant for calculating per acre volumes.

** The per acre averages shown for the forest types listed below the spruce type are based on small sample sizes and, therefore, have a high degree of sampling error associated with them.

TABLE 12.
Net volume per acre of sawtimber on commercial timberland
by forest type and ownership group, Working Circle 1
(thousand board feet Scribner per acre).

Forest Type	Ownership Group			
	State and Other Public	Forest Industry	Other Private	All Owners
	MBFS per acre			
Douglas-fir	7.0	6.1	3.1	5.3
Lodgepole pine	4.6	3.9	3.8	4.0
Ponderosa pine	4.8	5.3	3.2	4.4
Western larch	9.2	8.8	7.8	8.6
Subalpine fir	7.7	4.0	0.8	5.1
Grand fir	8.2	8.2	3.3	7.6
Spruce	14.0	9.4	5.0	8.2
Western redcedar	15.8	17.4	3.6	10.8**
Western hemlock	*	—	4.5	2.1
Whitebark pine	2.6	16.3	—	10.2
Western white pine	1.2	—	2.1	2.1
Juniper	—	—	0.4	0.4
Softwood types	7.1	6.1	3.7	5.6
Aspen	4.9	—	3.5	3.6
Cottonwood	1.8	1.8	0.7	0.9
Mixed hardwoods	*	—	0.4	0.4
Hardwood types	2.1	1.8	1.8	1.8
ALL FOREST TYPES	7.1	6.1	3.6	5.5

* Indicates numbers too insignificant for calculating per acre volumes.

**The per acre averages shown for the forest types listed below the spruce type are based on small sample sizes and, therefore, have a high degree of sampling error associated with them.

SALVABLE DEAD VOLUME

In 1977, about 123 million cubic feet of salvable dead timber was scattered throughout state and private forests in Working Circle 1 (see table 13). This volume was estimated to be equivalent to about 359 million board feet of saw-

timber, although dead timber seldom is sawed into boards.

Table 14 shows the distribution of the salvable dead timber by displaying acres of commercial timberland by salvable dead volume class. Seventy-five percent of the commercial timberland in the working circle held less than 100 cubic feet of salvable dead material per acre. About 2

TABLE 13.
Volume of salvable dead on commercial timberland
by ownership group and condition of dead, Working Circle 1
(thousand cubic feet).

Ownership Group	Condition of Dead			
	No Defect	Defect-Mostly Physical	Defect-Mostly Rot	Total
	thousand cubic feet			
State and other public	3,623	6,442	22,461	32,526
Forest industry	11,460	12,281	43,886	67,627
Other private	4,782	3,834	13,926	22,542
TOTAL	19,865	22,557	80,273	122,695

TABLE 14.
Area of commercial timberland by salvable dead volume
class and ownership group, Working Circle 1 (thousand acres).

Volume Class (Net cubic feet per acre)	State and Other Public	Forest Industry	Other Private	Total	Percentage of Total
	thousand acres				
None	129.9	415.0	315.8	860.7	54.5
1 - 100	53.9	166.5	106.5	326.9	20.7
101 - 200	47.1	131.4	25.4	204.0	12.9
201 - 300	21.9	51.9	20.3	94.1	5.9
301 - 400	8.1	30.1	8.4	46.6	2.9
401 - 500	5.7	11.6	—	17.3	1.1
501 - 600	4.2	—	—	4.2	0.3
601 - 700	—	8.7	—	8.7	0.5
701 - 800	2.8	4.3	—	7.1	0.4
801 - 900	2.8	—	—	2.8	0.2
901 - 1,000	2.8	—	—	2.8	0.2
1,001 - 1,100	1.4	—	4.2	5.6	0.4
1,101 +	—	—	—	—	—
TOTAL	280.8	819.4	480.6	1,580.8	100.0

percent of the commercial timberland--31,200 acres--held over 500 cubic feet of salvable dead material per acre. Almost half of this acreage--14,000 acres--was state and other public land.

To qualify as salvable dead material, standing or fallen dead trees must be at least 5.0 inches in diameter at breast height (d.b.h.) and more than 50 percent

sound on a cubic-foot basis.* Trees cut during logging and left on the site are not counted. Table 15 delineates the cu-

* Criteria for determining salvable dead trees are derived from the USFS Inter-mountain Forest and Range Experiment Station's 1977 field manual for Working Circle 1.

bic-foot volume of salvable dead timber according to different "condition of dead" classes. These classes are defined as follows:

No defect = tree exhibits no rot or physical defect.

Defect mostly physical = less than half of the total defect is due to rot and more than half is due to physical defects such as excessive sweep or crook.

Defect mostly rot = more than half of the total defect is due to rot and less than half is due to physical defects.

Most of the salvable dead timber in Working Circle 1--70 percent--was still standing at the time of sampling. Rot seemed to be the major defect in salvable dead trees. (NOTE: For a breakdown of

salvable dead volume by species and diameter class, see table 114 in appendix 1.)

Because salvable dead timber becomes unusable for many wood products after a short time, the figures shown in the accompanying tables are reliable only for the time of measurement. Nevertheless, these figures are useful for estimating how much salvable dead timber may be available in the future. Unfortunately, much of the estimated volume of salvable dead timber in the working circle is scattered and would be economically inoperable or inaccessible to salvage.

The amount of salvable dead timber in Working Circle 1 is expected to increase proportionately with the increase in mountain pine beetle activity. These increases will take place primarily within the lodgepole pine and ponderosa pine forest types.

TABLE 15.
Net volume of salvable dead on commercial timberland by
condition of dead class and forest type, Working Circle 1
(thousand cubic feet).

Forest Type	Condition Class						Total
	No Defect		Defect-Mostly Physical		Defect-Mostly Rot		
	Standing	Down	Standing	Down	Standing	Down	
	thousand cubic feet						
Douglas-fir	4,392	2,265	4,666	3,128	13,467	5,415	33,333
Lodgepole pine	7,734	720	3,035	139	13,497	4,744	29,869
Ponderosa pine	664	—	773	950	4,341	1,972	8,700
Western larch	—	100	3,069	728	8,430	2,974	15,301
Remaining soft-wood types	1,338	2,230	3,984	1,323	14,818	9,916	33,609
Hardwood types	422	—	763	—	636	61	1,882
ALL FOREST TYPES	14,550	5,315	16,290	6,268	55,189	25,082	122,694

GROWTH AND MORTALITY BY OWNERSHIP GROUP

Growth: Commercial forests on state and private lands in Working Circle 1 currently are growing at an annual rate of 65,904,000 net cubic feet or 208,397,000 net board feet Scribner (see tables 16

and 17). Over time, net growth will change in response to such factors as the forest's overall age and condition, mortality rates, and the amount of harvest.

Nearly half of the net growth--48 percent of the cubic-foot growth and 45 percent of the board-foot growth--takes place on forest industry lands. Per acre, trees on state and other public lands are

TABLE 16.
Net annual growth of growing stock on commercial
softwood and hardwood forest types by ownership group,
Working Circle 1 (thousand cubic feet).

Ownership Group	Softwood Types	Hardwood Types	Total
	thousand cubic feet		
State and other public	13,042	19	13,061
Forest industry	31,550	11	31,561
Other private	20,775	507	21,282
ALL OWNERS	65,367	537	65,904

TABLE 17.
Net annual growth of sawtimber on commercial
softwood and hardwood forest types by ownership group,
Working Circle 1 (thousand board feet Scribner).

Ownership Group	Softwood Types	Hardwood Types	Total
	thousand board feet		
State and other public	40,814	148	40,962
Forest industry	93,536	106	93,642
Other private	70,903	2,890	73,793
ALL OWNERS	205,253	3,144	208,397

growing at the fastest rate. Trees on other private lands and forest industry lands rank second and third in per acre growth (see table 18). Trees on an average acre of timberland in Working Circle 1 grow 41.9 net cubic feet or 131.5 net board feet Scribner per year.

Mortality: Data collected in 1977 indicate that state and private forest lands in Working Circle 1 lose around 34,276,000 net board feet or 12,956,000 net cubic feet of timber annually to natural mortality (see tables 19 and 20). This timber is removed from the commercial growing stock by natural causes such as insects, disease, fire, and weather. Timber removed through logging is not considered when computing mortality figures. Current mortality rates are

probably higher than those drawn from 1977 data because infestations of the bark beetle Dendroctonus ponderosae have increased since that time. To limit the impact of the bark beetle in this area, federal and state agencies are working with private industry to harvest those stands of timber currently under attack or likely to be attacked in the future. This, along with salvage operations, is an attempt to use as much timber as possible that might otherwise be lost.

On a per acre basis, mortality rates appeared to be highest on state and other public lands and lowest on lands owned by the other private ownership group. The average annual mortality rate in the working circle is 8.3 cubic feet per acre, or 22 board feet Scribner per acre (see table 20).

TABLE 18.

Annual mortality, net growth, and gross growth per acre for commercial softwood forest types by ownership group, Working Circle 1 (cubic feet and board feet Scribner).

	Ownership Group			Total
	State and Other Public	Forest Industry	Other Private	
Mortality				
Ft ³ /acre	8.9	8.9	6.7	8.3
BFS/acre	28.9	24.2	13.8	22.0
Net Growth				
Ft ³ /acre	46.6	38.5	44.9	41.9
BFS/acre	145.8	114.2	153.4	131.5
Gross Growth				
Ft ³ /acre	55.5	47.4	51.6	50.2
BFS/acre	174.7	138.4	167.2	153.5

TABLE 19.

Net annual mortality of growing stock on commercial softwood and hardwood forest types by ownership group, Working Circle 1 (thousand cubic feet).

Ownership Group	Softwood Types	Hardwood Types	Total
	<hr/> thousand cubic feet <hr/>		
State and other public	2,501	—	2,501
Forest industry	7,321	—	7,321
Other private	3,074	60	3,134
ALL OWNERS	12,896	60	12,956

TABLE 20.

Net annual mortality of sawtimber on commercial softwood and hardwood forest types by ownership group, Working Circle 1 (thousand board feet Scribner).

Ownership Group	Softwood Types	Hardwood Types	Total
	thousand board feet		
State and other public	8,082	—	8,082
Forest industry	19,831	—	19,831
Other private	6,363	—	6,363
ALL OWNERS	34,276	—	34,276

AREA BY SITE CLASS

All commercial timberlands sampled were placed in one of five productivity classes (see tables 21 and 22). As shown in table 31, almost half of these timberlands--49 percent--have the potential to produce from 50 to 84 cubic feet of timber per acre per year. Another 39 percent have the potential to produce more than 84 cubic feet of timber per acre per year. An average acre of commercial timberland in the working circle has the potential to produce 79 cubic feet of

timber per year. (Average potential productivity for the different forest types in Working Circle 1 is shown in table 38, page 55.)

The other private ownership group appears to own a slightly higher percentage of the most productive timberlands than the other two ownership groups. This indicates that these other private lands are potentially a little more productive than other lands in the working circle. State and other public lands have the second highest percentage of highly productive timberlands. Forest industry lands rank third.

TABLE 21.
Area of commercial timberland by forest type and
MAI site class, Working Circle 1 (acres).

Forest Type	Site Class (cubic feet/acre/year)					All Classes
	20-49	50-84	85-119	120-164	165+	
	acres					
Douglas-fir	101,623	404,014	173,763	46,272	—	725,672
Lodgepole pine	44,858	132,825	83,063	23,602	5,012	289,360
Ponderosa pine	22,331	70,909	33,962	10,102	1,447	138,751
Western larch	7,628	63,222	53,349	9,723	4,260	138,182
Subalpine fir	16,898	48,023	21,934	5,674	—	92,529
Grand fir	—	16,632	41,810	7,235	4,269	69,946
Spruce	—	28,275	23,803	5,403	—	57,481
Western redcedar	—	5,774	21,502	—	—	27,276
Western hemlock	—	—	3,828	4,258	—	8,086
Whitebark pine	7,062	791	—	—	—	7,853
Western white pine	—	—	—	3,998	—	3,998
Juniper	—	1,719	—	—	—	1,719
Softwood types	200,400	772,184	457,014	116,267	14,988	1,560,853
Aspen	—	—	—	7,918	—	7,918
Cottonwood	6,508	—	1,255	—	—	7,763
Mixed hardwoods	—	4,220	—	—	—	4,220
Hardwood types	6,508	4,220	1,255	7,918	—	19,901
ALL FOREST TYPES	206,908	776,404	458,269	124,185	14,988	1,580,754

TABLE 22.
Area of commercial timberland by MAI site class and
ownership group, Working Circle 1 (thousand acres).

Site Class (Ft ³ /acre/year)	Ownership Group							
	State and		Forest		Other		Working Circle	
	Other	Public	Industry		Private		Total	
	thousand acres							
	%		%		%		%	
20 - 49	28.5	10.2	131.7	16.1	46.7	9.7	206.9	13.1
50 - 84	137.7	49.0	416.1	50.8	222.6	46.3	776.4	49.1
85 - 119	89.8	32.0	215.1	26.2	153.4	31.9	458.3	29.0
120 - 164	22.5	8.0	52.2	6.4	49.5	10.3	124.2	7.9
165+	2.3	0.8	4.3	0.5	8.4	1.8	15.0	0.9
TOTAL	280.8	100.0	819.4	100.0	480.6	100.0	1,580.8	100.0

HABITAT TYPE

Pfister's forest habitat type classification system (Pfister et al. 1977) was used to determine habitat type and phase for the ten points sampled on each field plot. Inventory crew members estimated the percentage of ground covered by each indicator plant species, then identified each habitat type through the dichotomous habitat type key. The vegetative characteristics of the field plot were then compared to the written description of the indicated habitat type and phase to ensure that it was, in fact, the correct one.

Plant species' names are often abbreviated by combining the first two letters of the genus with the first two letters of the species. Abbreviations used for the habitat types are defined in table 23. Often a 1-acre field plot contains more than one habitat type. To simplify this analysis, each field plot was classified according to the dominant, or primary, habitat type. Table 24 shows the area of commercial timberland according to primary habitat type and Mean Annual Increment (MAI) site class.

Douglas-fir/pinegrass is the most common habitat type in Working Circle 1. This type covered one-fifth of the com-

mercial timberlands in the two lower site classes (20-49 and 50-84), but was seldom the indicated habitat type on the more productive lands. On these lands, wetter habitat types dominated. As shown in table 24, the most common habitat type on lands producing 85 or more cubic feet of timber per acre per year is western hemlock/queencup beadrily. This type covers 112,000 acres, or 19 percent of the more productive lands.

Habitat types were grouped to facilitate their analysis. The groups used were similar to those recommended by Pfister (Pfister et al. 1977), who formed them on the basis of their overall ecological similarities, which included their geographic distribution (see table 25).

Forest types occur over a large range of habitat type groups (see table 26). This indicates that a large part of the forest is in various seral stages of succession. For example, habitat type groups 15 and 16 are the most common groups in the working circle and most of the acreage occupied by these groups is covered by seral forest types. This is a favorable situation since seral stands are generally preferred commercially over those at climax.

TABLE 23.
Definitions of plant name abbreviations used
in habitat type tables.

Abbreviation	Scientific Name	Common Name
ABGR	<i>Abies grandis</i>	grand fir
ABLA	<i>Abies lasiocarpa</i>	subalpine fir
LALY	<i>Larix lyallii</i>	alpine larch
PIAL	<i>Pinus albicaulis</i>	whitebark pine
PICEA	<i>Picea</i>	spruce
PICO	<i>Pinus contorta</i>	lodgepole pine
PIFL	<i>Pinus flexilis</i>	limber pine
PIPO	<i>Pinus ponderosa</i>	ponderosa pine
PSME	<i>Pseudotsuga menziesii</i>	Douglas-fir
THPL	<i>Thuja plicata</i>	western redcedar
TSHE	<i>Tsuga heterophylla</i>	western hemlock
TSME	<i>Tsuga mertensiana</i>	mountain hemlock
AGSP	<i>Agropyron spicatum</i>	bluebunch wheatgrass
ALSI	<i>Alnus sinuata</i>	Sitka alder
AND	<i>Andropogon</i> spp.	bluestem
ARCO	<i>Arnica cordifolia</i>	heartleaf arnica
ARNU	<i>Aralia nudicaulis</i>	wild sarsaparilla
ARUV	<i>Arctostaphylos uva-ursi</i>	kinnikinnick
BERE	<i>Berberis repens</i>	creeping oregon grape
CACA	<i>Calamagrostis canadensis</i>	bluejoint
CAGE	<i>Carex geyeri</i>	elk sedge
CARU	<i>Calamagrostis rubescens</i>	pinegrass
CLPS	<i>Clematis pseudoalpina</i>	virgin's bower
CLUN	<i>Clintonia uniflora</i>	queencup beadlily
EQAR	<i>Equisetum arvense</i>	common horsetail
FEID	<i>Festuca idahoensis</i>	Idaho fescue
FESC	<i>Festuca scabrella</i>	rough fescue
GATR	<i>Galium triflorum</i>	sweetscented bedstraw
JUCO	<i>Juniperus communis</i>	common juniper
LIBO	<i>Linnaea borealis</i>	twinflower
LUHI	<i>Luzula hitchcockii</i>	smooth wood-rush
MEFE	<i>Menziesia ferruginea</i>	menziesia
OPHO	<i>Oplopanax horridum</i>	devil's club
PHMA	<i>Physocarpus malvaceus</i>	ninebark
PRVI	<i>Prunus virginiana</i>	chokecherry
PUTR	<i>Purshia tridentata</i>	bitterbrush
RIMO	<i>Ribes montigenum</i>	mountain gooseberry
SEST	<i>Senecio streptanthifolius</i>	cleft-leaf groundsel
SMST	<i>Smilacina stellata</i>	starry Solomon's seal
SPBE	<i>Spiraea betulifolia</i>	white spiraea
SYAL	<i>Symphoricarpos albus</i>	snowberry
SYOR	<i>Symphoricarpos oreophilus</i>	mountain snowberry
VACA	<i>Vaccinium caespitosum</i>	dwarf huckleberry
VAGL	<i>Vaccinium globulare</i>	blue huckleberry
VASC	<i>Vaccinium scoparium</i>	grouse whortleberry
XETE	<i>Xerophyllum tenax</i>	beargrass

TABLE 24.
Area of commercial timberland by primary habitat type
and MAI site class, Working Circle 1 (thousand acres).

Habitat Type	Site Class (cubic feet/acre/year)					Total
	20-49	50-84	85-119	120-164	165+	
	thousand acres					
PIPO/FEID	—	8.5	4.3	—	—	12.7
PIPO/SYAL	0.5	—	—	3.7	—	4.2
PSME/AGSP	1.3	2.8	—	—	—	4.1
PSME/FEID	—	4.3	—	—	—	4.3
PSME/FESC	9.0	1.3	8.8	—	—	19.1
PSME/VACA	21.4	65.5	45.7	4.3	—	136.9
PSME/PHMA	8.6	23.5	27.5	5.7	—	65.3
PSME/VAGL	5.7	19.0	—	—	—	24.7
PSME/LIBO	13.5	33.2	16.7	12.8	—	76.3
PSME/SYAL	7.0	101.1	20.8	10.9	—	139.8
PSME/CARU	63.8	138.6	12.9	5.8	—	221.1
PSME/CAGE	7.1	4.8	2.9	1.3	—	16.1
PSME/SPBE	5.7	12.7	—	—	—	18.4
PSME/ARUV	8.6	8.7	4.3	—	—	21.6
PICEA/EQAR	—	4.3	13.0	—	—	17.3
PICEA/CLUN	—	25.6	16.3	5.4	—	47.3
PICEA/GATR	6.5	6.1	—	—	—	12.6
PICEA/VACA	4.0	9.9	5.8	—	—	19.7
PICEA/LIBO	1.4	8.5	5.8	—	—	15.8
ABGR/XETE	—	8.7	—	—	—	8.7
ABGR/CLUN	1.5	54.9	65.2	19.5	1.4	142.6
ABGR/LIBO	4.3	75.4	20.7	7.1	—	107.6
THPL/CLUN	3.8	32.5	57.7	11.1	0.8	105.9
TSHE/CLUN	—	33.2	76.6	22.7	12.7	145.2
ABLA/CLUN	6.4	47.3	27.8	12.6	—	94.0
ABLA/GATR	—	3.7	—	—	—	3.7
ABLA/VACA	—	9.1	6.8	—	—	15.9
ABLA/LIBO	—	0.7	—	—	—	0.7
ABLA/MEFE	5.5	6.4	7.0	1.4	—	20.3
ABLA/XETE	11.6	14.1	8.7	—	—	34.4
ABLA/CAGE	—	7.0	—	—	—	7.0
ABLA/LUHI	4.1	5.0	2.8	—	—	11.9
TSME/LUHI	4.3	—	—	—	—	4.3
PIAL/ABLA	1.3	—	—	—	—	1.3
TOTAL	206.9	776.4	458.3	124.2	15.0	1,580.8

TABLE 25.
Habitat type group definitions.

Group	Definitions
1	PIFL climax series; PIFL/AGSP h.t.; PIFL/FEID h.t., -FEID AND -FESC PHASES; PIFL/JUCO h.t.
2	Scree
3	PIPO/AND h.t.; PIPO/AGSP h.t.; PIPO/FEID h.t., -FESC phase; PIPO/PUTR h.t., -FEID phase.
4	PIPO/SYAL h.t., -SYAL and -BERE phases; PIPO/PRVI h.t.
5	PSME/AGSP h.t.; PSME/FEID h.t.; PSME/FESC h.t.; PSME/SYOR h.t.
6	PSME/VACA h.t.; PSME/CARU, -ARUV phase.
7	PSME/PHMA h.t.; PSME/SYAL h.t., -CARU and -SYAL phases.
8	PSME/VAGL h.t.; PSME/LIBO h.t., -SYAL and -VAGL phases.
9	PSME/CARU, -AGSP phase; PSME/CARU, -PIPO phase; PSME/SYAL, -AGSP phase.
10	PSME/CARU, -CARU phase; PSME/CAGE h.t.
11	PSME/SPBE h.t.; PSME/ARUV h.t.
12	PSME/JUCO h.t.; PSME/ARCO h.t.
13	PICEA/CLUN h.t., -VACA and -CLUN phases; PICEA/VACA h.t.
14	PICEA/PHMA h.t.; PICEA/GATR h.t.; PICEA/SEST h.t.; PICEA/LIBO h.t.; PICEA/SMST h.t.
15	ABGR/XETE h.t.; ABGR/CLUN, -CLUN, -ARNU, and -XETE phases; ABGR/LIBO h.t., -LIBO and -XETE phases.
16	THPL/CLUN h.t., -CLUN, -ARNU, and MEFE phases; TSHE/CLUN h.t., -CLUN and -ARNU phases.
17	PICEA/EQAR h.t.; THPL/OPHO h.t.; ABLA/OPHO h.t.
18	ABLA/CLUN h.t., -CLUN, -VACA, -XETE, and -MEFE phases; ABLA/GATR h.t.; ABLA/LIBO h.t., -XETE phase.
19	ABLA/VACA
20	ABLA/CACA h.t., -CACA and -GATR phases.
21	ABLA/MEFE h.t.; TSME/MEFE h.t.; ABLA/ALSI h.t.
22	ABLA/XETE, -VAGL phase; TSME/XETE h.t.; ABLA/VAGL h.t.
23	ABLA/XETE, -VASC phase; ABLA/VASC h.t.; ABLA/CAGE, -CAGE phase.
24	ABLA/CARU h.t.; ABLA/ARCO h.t.; ABLA/CAGE, -PSME phase.
25	PICEA/SEST h.t., -PSME phase; ABLA/CLPS h.t.
26	ABLA/LUHI h.t., -VASC and -MEFE phases; TSME/LUHI h.t., -VASC phase; ABLA/PIAL, -VASC phase; ABLA/RIMO h.t.
27	PIAL/ABLA h.t.; LALY/ABLA h.t.; PIAL h.t.
28	PICO climax series.
29	Hardwood climax series.

TABLE 26.
Area of commercial timberland by primary habitat type group
and forest type, Working Circle 1 (thousand acres).

Primary Type Group	Habitat	Douglas- fir	Lodgepole pine	Ponderosa pine	Western larch	Softwood Forest Types				Western redcedar	Western hemlock
						Subalpine fir	Grand fir	Spruce	thousand acres		
Habitat Group 1	—	—	—	—	—	—	—	—	—	—	—
Habitat Group 2	—	—	—	—	—	—	—	—	—	—	—
Habitat Group 3	—	—	—	12.7	—	—	—	—	—	—	—
Habitat Group 4	—	0.5	—	—	—	—	—	—	—	—	—
Habitat Group 5	10.8	—	—	16.7	—	—	—	—	—	—	—
Habitat Group 6	111.5	68.1	—	31.6	17.9	—	—	—	—	—	—
Habitat Group 7	146.8	4.3	—	15.7	9.9	—	—	—	—	—	—
Habitat Group 8	61.8	27.8	—	4.3	7.1	—	—	—	—	—	—
Habitat Group 9	84.0	—	—	29.4	—	—	—	—	—	—	—
Habitat Group 10	42.2	6.2	—	5.8	—	—	—	—	—	—	—
Habitat Group 11	30.0	—	—	9.9	—	—	—	—	—	—	—
Habitat Group 12	—	—	—	—	—	—	—	—	—	—	—
Habitat Group 13	24.1	27.9	—	—	5.6	1.3	—	8.1	—	—	—
Habitat Group 14	3.3	10.0	—	—	4.2	4.4	—	—	—	—	—
Habitat Group 15	145.4	31.4	—	7.6	32.6	—	21.3	20.6	—	—	—
Habitat Group 16	37.9	54.5	—	0.6	37.5	24.3	48.6	2.8	27.3	—	8.1
Habitat Group 17	—	4.2	—	4.4	—	—	—	8.7	—	—	—
Habitat Group 18	22.7	7.0	—	—	15.7	36.3	—	16.5	—	—	—
Habitat Group 19	3.7	10.9	—	—	1.4	—	—	—	—	—	—
Habitat Group 20	—	—	—	—	—	—	—	—	—	—	—
Habitat Group 21	1.4	6.8	—	—	—	11.3	—	0.8	—	—	—
Habitat Group 22	—	11.4	—	—	6.2	2.8	—	—	—	—	—
Habitat Group 23	—	18.4	—	—	—	1.3	—	—	—	—	—
Habitat Group 24	—	—	—	—	—	—	—	—	—	—	—
Habitat Group 25	—	—	—	—	—	—	—	—	—	—	—
Habitat Group 26	—	—	—	—	—	9.7	—	—	—	—	—
Habitat Group 27	—	—	—	—	—	1.3	—	—	—	—	—
Habitat Group 28	—	—	—	—	—	—	—	—	—	—	—
Habitat Group 29	—	—	—	—	—	—	—	—	—	—	—
TOTAL	725.7	289.4	138.7	138.2	92.5	69.9	57.5	27.3	8.1		

TABLE 26. (cont'd.)

Primary Type Group	Habitat	Whitebark pine	Western white pine	Juniper	Total Softwoods	Aspen thousand acres	Cotton- wood	Other Hardwoods	Total Hardwoods	Total All Species
Habitat Group 1	—	—	—	—	—	—	—	—	—	—
Habitat Group 2	—	—	—	—	—	—	—	—	—	—
Habitat Group 3	—	—	—	—	12.7	—	—	—	—	12.7
Habitat Group 4	—	—	—	—	0.5	3.7	—	—	3.7	4.2
Habitat Group 5	—	—	—	—	27.5	—	—	—	—	27.5
Habitat Group 6	—	—	—	—	229.0	—	—	—	—	229.0
Habitat Group 7	—	—	—	—	176.7	—	—	4.3	4.3	180.9
Habitat Group 8	—	—	—	—	101.0	—	—	—	—	101.0
Habitat Group 9	—	—	—	1.7	115.1	—	—	—	—	115.1
Habitat Group 10	—	—	—	—	54.2	—	—	—	—	54.2
Habitat Group 11	—	—	—	—	40.0	—	—	—	—	40.0
Habitat Group 12	—	—	—	—	—	—	—	—	—	—
Habitat Group 13	—	—	—	—	67.0	—	—	—	—	67.0
Habitat Group 14	—	—	—	—	21.9	—	6.5	—	6.5	28.4
Habitat Group 15	—	—	—	—	258.9	—	—	—	—	258.9
Habitat Group 16	—	—	4.0	—	245.6	4.3	1.3	—	5.5	251.1
Habitat Group 17	—	—	—	—	17.3	—	—	—	—	17.3
Habitat Group 18	—	—	—	—	98.4	—	—	—	—	98.4
Habitat Group 19	—	—	—	—	15.9	—	—	—	—	15.9
Habitat Group 20	—	—	—	—	—	—	—	—	—	—
Habitat Group 21	—	—	—	—	20.3	—	—	—	—	20.3
Habitat Group 22	1.3	—	—	—	21.7	—	—	—	—	21.7
Habitat Group 23	—	—	—	—	19.7	—	—	—	—	19.7
Habitat Group 24	—	—	—	—	—	—	—	—	—	—
Habitat Group 25	—	—	—	—	—	—	—	—	—	—
Habitat Group 26	6.5	—	—	—	16.2	—	—	—	—	16.2
Habitat Group 27	—	—	—	—	1.3	—	—	—	—	1.3
Habitat Group 28	—	—	—	—	—	—	—	—	—	—
Habitat Group 29	—	—	—	—	—	—	—	—	—	—
TOTAL		7.9	4.0	1.7	1,560.9	7.9	7.8	4.3	19.9	1,580.8

THE GRAZABLE FOREST LAND RESOURCE

For each field location sampled, range condition, an estimate of the departure from climax of the understory vegetation, was calculated. It was assumed that the forage potential of understory vegetation in stands of timber with a crown density greater than 70 percent was so low that these sites could be ignored.

Also, although other forest lands (noncommercial) have the potential to produce relatively large amounts of forage, these lands were seldom visited by inventory crew members and, thus, were not sampled.

The data summarized in tables 27 through 31 were obtained from grazing guides developed by the SCS. Appendix 4 contains a sample grazing guide and an example of the field data forms used.

OVERALL CONDITIONS

Understory vegetation was estimated to be in good or excellent condition on 1,008,000 acres of the commercial forest or 85 percent of the sampled grazable forest land. Understory vegetation on another 182,900 acres was found to be in fair or poor condition. The remaining 389,800 acres had crown densities greater than 70 percent and thus, were thought to contain little or no grazable forage (see table 28).

Commercial timberlands with crown densities of 0-30 percent were the most overgrazed. Nearly one-third--29 percent--of these timberlands were in fair or poor condition. Seven percent of the lands within the 31-50 percent crown density group and 11 percent of the lands within the 51-70 percent group had understory vegetation in poor or fair condition. Forest understories in poor or fair condition should be rested by reducing or eliminating grazing for a period of time.

This will allow the natural balance within the plant community to be restored and ultimately increase the forage available for grazing. If the understory is not rested and the amount of grazing that produced the poor or fair condition continues, the understory will keep declining until the forage is virtually worthless for grazing. Overgrazing also can impair the health of livestock, water quality, and other resources.

A comparison of understory conditions shows that the other private group owned the highest percentage of fair- and poor-rated forested rangeland in Working Circle 1. About 20 percent of the grazable forest land owned by the other private group--75,400 acres--was in fair or poor condition, as compared to 13 percent--78,200 acres--owned by the forest industry and 15 percent--29,100 acres--by state and other public groups. Unless range conditions are now improving, these lands will need an immediate reevaluation of their stocking rates. Grazable forest lands rated as good or excellent may also be experiencing overgrazing. Thus, these areas also may need their stocking rates lowered to avoid further decline.

CURRENT CARRYING CAPACITY

The current carrying capacity, usually defined as available animal unit months (AUMs), is drawn from the condition of the forest's understory vegetation, crown density, and an adjustment based on the amount of the area that will be grazed by livestock (primarily cattle). This adjustment is called a grazability factor or a utilization cut.

The available AUMs shown in tables 29 and 30 are actually recommended livestock stocking rates. (See the definition of animal units in the glossary.) According

TABLE 27.
Area of commercial timberland by crown density, condition class, and
climax series, Working Circle 1 (thousand acres).

Condition Class	Climax Series							Total
	Ponderosa pine	Douglas fir	Spruce	Grand fir	Western redcedar	Western hemlock	Subalpine fir	
	—thousand acres—							
Crown Density 0-30								
Excellent	3.7	48.9	—	35.2	5.0	13.5	9.3	115.6
Good	4.3	99.5	11.6	15.7	8.3	14.1	10.7	164.2
Fair	0.5	55.8	5.7	6.1	5.5	—	17.1	90.7
Poor	—	17.2	—	—	—	—	6.4	23.6
TOTAL	8.5	221.4	17.3	57.0	18.8	27.6	43.5	394.1
Crown Density 31-50								
Excellent	—	192.4	29.7	35.7	2.2	17.1	16.6	293.7
Good	4.3	81.8	1.4	5.4	13.5	17.2	12.3	135.9
Fair	—	8.9	4.3	—	2.8	—	5.3	21.3
Poor	4.2	3.8	—	—	1.3	—	—	9.3
TOTAL	8.5	286.9	35.4	41.1	19.8	34.3	34.2	460.2
Crown Density 51-70								
Excellent	—	90.4	16.0	43.3	5.4	18.8	12.8	186.7
Good	—	36.7	9.6	9.7	14.2	12.9	28.9	112.0
Fair	—	8.6	4.0	4.0	4.3	—	11.4	32.3
Poor	—	—	—	1.4	—	—	4.3	5.7
TOTAL	—	135.7	29.6	58.4	23.9	31.7	57.4	336.7
Crown Density 71+	—	103.5	30.4	102.3	43.5	51.6	58.5	389.8
Totals for all crown densities								
Excellent	3.7	331.7	45.7	114.2	12.6	49.4	38.7	596.0
Good	8.6	218.0	22.6	30.8	36.0	44.2	51.9	412.1
Fair	0.5	73.3	14.0	10.1	12.6	—	33.8	144.3
Poor	4.2	21.0	—	1.4	1.3	—	10.7	38.6
71+ crown density	—	103.5	30.4	102.3	43.5	51.6	58.5	389.8
TOTAL	17.0	747.5	112.7	258.8	106.0	145.2	193.6	1,580.8

TABLE 28.
Area of commercial timberland by condition class,
crown density, and ownership group,
Working Circle 1 (thousand acres).

Condition Class and Crown Density	Ownership Group			Total
	State and Other Public	Forest Industry	Other Private	
	<hr/> thousand acres <hr/>			
Excellent				
0 - 30	10.9	59.1	45.6	115.6
31 - 50	34.3	173.8	85.5	293.6
51 - 70	46.1	100.2	40.5	186.7
TOTAL	91.2	333.1	171.6	596.0
Good				
0 - 30	23.7	101.0	39.5	164.2
31 - 50	26.1	61.9	47.9	135.9
51 - 70	27.5	39.2	45.4	112.1
TOTAL	77.3	202.0	132.8	412.2
Fair				
0 - 30	9.6	55.9	25.2	90.7
31 - 50	7.7	0.7	12.9	21.3
51 - 70	7.2	8.6	16.5	32.3
TOTAL	24.5	65.1	54.6	144.2
Poor				
0 - 30	2.8	8.5	12.2	23.5
31 - 50	0.4	0.3	8.6	9.3
51 - 70	1.4	4.3	—	5.7
TOTAL	4.6	13.1	20.8	38.5
Crown Density Totals				
0 - 30	47.0	224.5	122.5	394.0
31 - 50	68.4	236.8	154.9	460.1
51 - 70	82.2	152.2	102.4	336.8
70 +	83.1	206.0	100.8	389.9
WORKING CIRCLE TOTALS	280.8	819.4	480.6	1,580.8

TABLE 29.
Available animal unit months (AUMs) on commercial timberland by crown density,
condition class, and climax series, Working Circle 1.

Condition Class	Ponderosa pine	Douglas- fir	Spruce	Climax Series				Subalpine fir	Total
				Grand fir	Western redcedar	Western hemlock	AUMs		
Crown Density 0-30									
Excellent	1,811	15,028	—	9,309	1,166	4,652		2,767	34,733
Good	1,193	21,616	4,185	3,535	1,301	3,428		2,293	37,551
Fair	93	11,986	1,023	750	651	—		3,941	18,444
Poor	—	2,503	—	—	—	—		206	2,709
TOTAL	3,097	51,133	5,208	13,594	3,118	8,080		9,207	93,437
Crown Density 31-50									
Excellent	—	36,193	5,661	4,856	606	3,942		3,744	55,002
Good	811	11,222	63	724	981	1,470		677	15,948
Fair	—	2,057	636	—	46	—		175	2,914
Poor	418	379	—	—	62	—		—	859
TOTAL	1,229	49,851	6,360	5,580	1,695	5,412		4,596	74,723
Crown density 51-70									
Excellent	—	11,122	1,233	1,314	512	1,117		894	16,192
Good	—	3,273	861	326	697	621		1,375	7,153
Fair	—	994	192	110	85	—		79	1,460
Poor	—	—	—	70	—	—		2	72
TOTAL	—	15,389	2,286	1,820	1,294	1,738		2,350	24,877
Totals for all crown densities*									
Excellent	1,811	62,343	6,894	15,479	2,284	9,711		7,405	105,927
Good	2,004	36,111	5,109	4,585	2,979	5,519		4,345	60,652
Fair	93	15,037	1,851	860	782	—		4,195	22,818
Poor	418	2,882	—	70	62	—		208	3,640
TOTAL	4,326	116,373	13,854	20,994	6,107	15,230		16,153	193,037

* Does not include crown density 71+ since range data is not recorded for this category.

TABLE 30.
Available animal unit months (AUMs) on commercial
timberland by condition class, crown density
and ownership group, Working Circle 1.

Condition Class and Crown Density	Ownership Group			Total
	State and Other Public	Forest Industry	Other Private	
	AUMs			
Excellent				
0 - 30	2,245	15,904	16,584	34,733
31 - 50	7,747	29,158	18,097	55,002
51 - 70	3,140	9,149	3,904	16,193
TOTAL	13,132	54,211	38,585	105,928
Good				
0 - 30	4,105	25,272	8,173	37,550
31 - 50	2,636	7,473	5,838	15,947
51 - 70	1,671	1,591	3,891	7,153
TOTAL	8,412	34,336	17,902	60,650
Fair				
0 - 30	1,006	12,541	4,895	18,442
31 - 50	390	11	2,513	2,914
51 - 70	58	118	1,285	1,461
TOTAL	1,454	12,670	8,693	22,817
Poor				
0 - 30	171	774	1,764	2,709
31 - 50	21	17	822	860
51 - 70	71	2	—	73
TOTAL	263	793	2,586	3,642
Crown density totals				
0 - 30	7,527	54,491	31,416	93,434
31 - 50	10,794	36,659	27,270	74,723
51 - 70	4,940	10,860	9,080	24,880
WORKING CIRCLE TOTALS*	23,261	102,010	67,766	193,037

*Does not include crown density 71+ since range data is not recorded for this category.

TABLE 31.
Potential available animal unit months (AUMs) on commercial timberland
by crown density and climax series, Working Circle 1.

	Climax Series							
Crown Density	Ponderosa pine	Douglas- fir	Spruce	Grand fir	Western redcedar	Western hemlock	Subalpine fir	Total
	AUMs							
0 - 30	3,700	77,098	7,474	16,149	5,662	8,977	14,557	133,617
31 - 50	2,882	60,395	7,024	6,228	3,193	6,883	5,287	91,892
51 - 70	—	16,492	2,478	1,757	1,814	2,049	2,380	26,970
71+	—	—	—	—	—	—	—	—
TOTAL	6,582	153,985	16,976	24,134	10,669	17,909	22,224	252,479

to the Montana grazing guides, if these stocking rates are followed, understory conditions will gradually improve. Of course, sound range management, including grazing during the correct season of the year and proper distribution of livestock over the grazable forested area, also must be applied.

The total carrying capacity or recommended stocking rate for sampled commercial timberlands in Working Circle 1 was estimated to be 193,037 AUMs at the time of this inventory. Over half of these AUMs--60 percent--can be carried on Douglas-fir climax forest lands. Also, most of vegetation on which this carrying capacity is based occurs on forest lands with 0-30 percent crown canopies, where shading from tall brush and trees does not inhibit the growth of grazable forage.

Forest industry-owned lands can support 102,010 AUMs, or 53 percent of the working circle total (see table 30).

POTENTIAL CARRYING CAPACITY

Potential available AUMs, shown in tables 31 and 32, are the number of AUMs that could be supported if every acre of

grazable forest land were in excellent condition. In 1977, a total of 272,479 AUMs could have been supported on sampled commercial timberlands in Working Circle 1. The Douglas-fir climax forest could support over half of these potential AUMs--61 percent; forest lands with 0-30 percent crown canopies could support 53 percent. Forest industry-owned land had the potential to support the highest number of AUMs--132,467 or 52 percent of the potential working circle total.

Timberlands in Working Circle 1 carried 193,037 AUMs or 76 percent of the potential available AUMs. If every grazable forest acre were in excellent condition, the 1977 carrying capacity could have been increased by 59,442 AUMs. Translated into head of cattle, assuming a four-month grazing season, the recommended stocking rate could have been increased from 48,259 to 63,120 head.

The potential number of AUMs depends on more than just the understory condition. Other factors, like the number of acres in each crown density group and utilization cuts, also affect a range's carrying capacity. Obviously, one way to increase AUMs would be to harvest enough timber so that every acre would have a crown density of 0-30 percent. A more practical and realistic way to increase

TABLE 32.
Potential available animal unit months (AUMs)
on commercial timberland by crown density and ownership group,
Working Circle 1.

Crown Density	Ownership Group			Total
	State and Other Public	Forest Industry	Other Private	
	AUMs			
0 - 30	12,213	77,918	43,487	133,618
31 - 50	13,234	43,355	35,303	91,892
51 - 70	5,011	11,194	10,764	26,969
TOTAL	30,458	132,467	89,554	252,479

potential available AUMs is to reduce utilization cuts through effective range management. Salting, herding, fencing, increasing the number of trails, increasing water developments, and reducing slash, debris, and other mechanical barriers are some of the management techniques that might be used. Properly ap-

plied, these methods will increase the amount of grazed forest land and, thus, the range's carrying capacity. An analysis of use data indicates that at least 218,000 acres of grazable forest land would benefit significantly from such techniques.

ANALYSIS OF THE TIMBER RESOURCE

In this analysis, forest inventory data were used to determine the biological condition of the forest for maximizing timber production. These data also were used to assess timber availability and the quality of the forest land for timber production. Some specific areas examined were: silvicultural treatment opportunities, stand age distribution, timberland quality classes, current growth and mortality, stocking, and the forest's biological potential for growing wood.

FOREST CONDITION

Growth and Mortality

Gross Growth

At the time of measurement, gross growth in cubic feet per year for all softwood species was about 2.8 percent of the working circle's total cubic-foot softwood volume (see table 33). Lodgepole pine exhibited the highest rate of growth with an annual increase in total cubic-foot volume of 3.5 percent. Western larch and ponderosa pine grew the least--1.9 percent of their total cubic-foot volumes.

Gross growth in board feet Scribner for all softwood species was about 2.7 percent of the working circle's total board-foot volume. Lodgepole pine also showed the highest growth rate in this category--4.2 percent of its total board-foot Scribner volume. Western larch again grew the least--1.7 percent of its total board-foot Scribner volume. In comparison, gross growth of softwood species in the Rocky Mountain region as a whole was 2.2 percent of both the total cubic-foot and board-foot Scribner volumes of softwoods (USFS 1978).

Most of this growth occurred in Douglas-fir. Table 33 shows that 34 percent of the cubic-foot growth in all softwood species, as well as 36 percent of the board-foot growth in these species, occurred in Douglas-fir.

Gross growth by diameter class data indicate that younger trees grow more quickly than older trees and that the growth rate decreases with age (see tables 34 and 35). These data also show that over half of the forest's gross growth, both in cubic feet and board feet, occurred in the two smallest diameter classes.

Mortality

Mortality data collected in 1977 indicated that mortality was not occurring at an excessive rate at that time. Natural mortality in softwoods, expressed as a percentage of the total softwood volume was 0.5 percent of the total cubic-foot volume or 0.4 percent of the total board-foot volume on commercial timberlands in Working Circle 1. Mortality in the entire Rocky Mountain region during 1976 was estimated at 0.5 percent of the total cubic-foot and total board-foot volumes (USFS 1978). In 1977, mortality equalled 17 percent of the cubic-foot gross growth and 14 percent of the board-foot gross growth taking place in the working circle.

Loss of cubic-foot volume was highest in lodgepole pine (see table 36) with a mortality rate of 0.7 percent. Loss of board-foot volume was highest in grand fir (see table 37), even though grand fir makes up only 5 percent of the working circle's total board-foot volume. This species exhibited a mortality rate of 1.6 percent, or four times the rate estimated for all softwoods combined. Ponderosa

TABLE 33.

Net cubic foot and board foot Scribner volumes, gross growth, mortality and net growth by species on commercial timberland for Working Circle 1 (thousand cubic feet, thousand board feet Scribner).

	Growing Stock		Sawtimber	
	M Net Cubic Foot Volume	Percentage of Total CF Volume	M Net Board Foot Scribner Volume	Percentage of Total BFS Volume
Douglas-fir				
Total Volume	891,655	100.0	2,873,542	100.0
Gross Growth	26,311	3.0	84,632	2.9
Mortality	2,795	0.3	7,071	0.2
Net Growth	23,516	2.6	77,561	2.7
Ponderosa pine				
Total Volume	273,116	100.0	1,238,781	100.0
Gross Growth	5,177	1.9	24,614	2.0
Mortality	547	0.2	1,739	0.1
Net Growth	4,630	1.7	22,875	1.8
Lodgepole pine				
Total Volume	571,717	100.0	833,833	100.0
Gross Growth	19,868	3.5	35,270	4.2
Mortality	3,860	0.7	5,278	0.6
Net Growth	16,008	2.8	29,992	3.6
Western larch				
Total Volume	510,919	100.0	2,091,619	100.0
Gross Growth	9,699	1.9	36,181	1.7
Mortality	1,546	0.3	6,676	0.3
Net Growth	8,153	1.6	29,505	1.4
All other softwoods				
Total Volume	487,710	100.0	1,573,846	100.0
Gross Growth	15,862	3.3	55,903	3.6
Mortality	4,040	0.8	13,513	0.9
Net Growth	11,822	2.4	42,390	2.7
TOTAL FOR ALL SOFTWOODS				
Total Volume	2,735,117	100.0	8,611,621	100.0
Gross Growth	76,917	2.8	236,600	2.7
Mortality	12,788	0.5	34,277	0.4
Net Growth	64,129	2.3	202,323	2.3

TABLE 34.
Growing stock net volume, gross growth, mortality, and
net growth on commercial timberland by diameter class
for softwood species, Working Circle 1 (thousand cubic feet).

Diameter Class	Volume	Gross Growth		Mortality		Net Growth	
		thousand cubic feet		thousand cubic feet		thousand cubic feet	
			%*		%*		%*
5.0 - 6.9	393,067	29,839	7.6	3,109	0.8	26,730	6.8
7.0 - 8.9	410,536	12,486	3.0	1,947	0.5	10,539	2.5
9.0 - 10.9	360,098	9,647	2.7	1,240	0.3	8,407	2.4
11.0 - 12.9	310,430	7,265	2.3	975	0.3	6,290	2.0
13.0 - 14.9	272,492	5,598	2.1	1,625	0.6	3,973	1.5
15.0 - 16.9	226,743	4,051	1.8	1,060	0.5	2,991	1.3
17.0 - 18.9	199,003	2,971	1.5	663	0.3	2,308	1.2
19.0 - 20.9	139,242	1,656	1.2	755	0.5	901	0.7
21.0 - 22.9	115,580	1,175	1.0	250	0.2	925	0.8
23.0 - 24.9	86,622	754	0.9	228	0.3	526	0.6
25.0 - 26.9	70,529	517	0.7	244	0.3	273	0.4
27.0 - 28.9	47,719	344	0.7	37	0.1	307	0.6
29.0 +	103,056	612	0.6	654	0.6	- 42	**
TOTAL	2,735,117	76,915	2.8	12,787	0.5	64,128	2.3

*Percentage of the cubic foot volume for each diameter class.

**Indicates less than 0.05 percent.

TABLE 35.
Sawtimber net volume, gross growth, mortality, and
net growth on commercial timberland by diameter class for
softwood species, Working Circle 1 (thousand board feet Scribner).

Diameter Class	Volume	Gross Growth		Mortality		Net Growth	
		thousand board feet		thousand board feet		thousand board feet	
			%*		%*		%*
9.0 - 10.9	1,102,032	102,690	9.3	3,488	0.3	99,202	9.0
11.0 - 12.9	1,295,141	39,411	3.0	4,248	0.3	35,163	2.7
13.0 - 14.9	1,237,585	29,998	2.4	7,499	0.6	22,499	1.8
15.0 - 16.9	1,071,218	21,226	2.0	5,076	0.5	16,150	1.5
17.0 - 18.9	965,939	15,480	1.6	3,208	0.3	12,272	1.3
19.0 - 20.9	690,071	8,667	1.3	3,460	0.5	5,207	0.8
21.0 - 22.9	590,886	6,432	1.2	1,281	0.2	5,151	1.0
23.0 - 24.9	455,421	4,283	0.9	1,179	0.3	3,104	0.6
25.0 - 26.9	377,096	2,950	0.8	1,262	0.3	1,688	0.5
27.0 - 28.9	256,728	1,959	0.8	191	0.1	1,768	0.7
29.0 +	569,504	3,506	0.6	3,384	0.6	122	**
TOTAL	8,611,621	236,602	2.7	34,276	0.4	202,326	2.3

*Percentage of the board foot volume for each diameter class.

**Indicates less than 0.05 percent.

TABLE 36.
Net annual mortality of growing stock on commercial timberland
by species and cause of death, Working Circle 1 (thousand cubic feet).

Species	Cause of Death						Total (all causes)
	Insects	Disease	Fire	Animal	Weather	Suppression	
						thousand cubic feet	
Douglas-fir	317	803	—	34	179	—	758
Lodgepole pine	902	84	99	—	312	278	85
Ponderosa pine	363	—	—	—	—	—	184
Western larch	271	565	93	—	370	—	200
Subalpine fir	22	481	—	—	84	—	239
Grand fir	62	1,241	—	—	150	—	302
Spruce	104	78	—	—	68	—	133
Western redcedar	—	69	—	—	—	—	—
Western hemlock	—	—	—	—	—	—	—
Whitebark pine	—	41	—	—	60	—	28
Western white pine	—	145	—	—	—	—	78
Softwood Species	2,041	3,507	192	34	1,223	278	3,968
							1,545
							12,788
Aspen	—	—	—	—	60	—	108
Cottonwood	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—
Hardwood Species	—	—	—	—	60	—	108
							168
TOTAL	2,041	3,507	192	34	1,283	278	4,076
							1,545
							12,956

pine, with a mortality rate equalling 0.2 percent of its total cubic-foot volume or 0.1 percent of its total board-foot volume, exhibited the lowest mortality rate.

Tables 36 and 37 show that mortality is higher in the 14- to 20-inch-diameter classes than might be expected based on mortality figures for the other diameter classes. This trend is particularly apparent when board-foot volumes are compared. The tables also show that softwood trees 29 inches in diameter or larger are dying at about the same rate they are growing.

In 1977 the major causes of tree death were categorized as unknown, disease, and insects (see tables 34 and 35). Disease includes various rots, rusts, and mistletoe. Insects include bark beetles and, occasionally, defoliators. The category termed "unknown" was used by inventory crews when they could not determine which damaging agent killed the tree. Although the inventory procedure allowed only one damaging agent to be recorded, frequently the death of a tree was caused by two or more agents in concert or succession.

Lodgepole pine trees were the major victims of insects and unknown factors, while most of the trees killed by disease were grand fir.

Weather and logging also contributed significantly to mortality. Weather was assigned as the cause of mortality to trees that died due to windthrow, snow breakage, and lightning. Logging mortality included trees killed by activities occurring during the logging operation--it did not include the actual trees cut for harvest.

At the time of measurement, insects and disease shared dominant roles as the major causes of death in Working Circle 1. However, the causes of mortality in a forest are dynamic and cyclic, and in a future inventory the major causes of death may be different. Since 1977, the mortality situation has changed dramatically. It is fairly safe to assume that insects now are by far the major cause of mortality in Working Circle 1. The mountain pine beetle (Dendroctonus ponderosae Hopk.) epidemic was just beginning in 1977 and has escalated since that time. Thus, lodgepole pine mortality should be

much higher now than it was in 1977. Ponderosa pine mortality also has probably increased. In addition, a spruce beetle (Dendroctonus rufipennis) epidemic that has surfaced in the area since 1977 has probably increased spruce mortality.

Net Growth

In 1977, net annual growth of softwoods in Working Circle 1 was 64,129,000 cubic feet or 202,323,000 board feet. This represented 2.3 percent of the total softwood volume. For the Rocky Mountain region as a whole, net growth of softwoods was 1.7 percent in 1976 (USFS 1978). Lodgepole pine showed the highest net growth rate; this species increased its cubic-foot volume by 2.8 percent and its board-foot volume by 3.6 percent. Western larch had the lowest net growth rate (see table 33).

Over time, net growth will increase or decrease in response to changes in mortality rates, harvest rates, amounts of insects or disease, and the forest's stocking and age distribution. Consequently, due to the increased mountain pine beetle infestation in Working Circle 1, the current net growth in lodgepole pine and ponderosa pine is probably lower than it was in 1977.

Potential Growth

Potential growth or yield is net growth expressed in cubic feet per acre per year as calculated by the forest inventory computation process. The estimate is based on site trees measured on each field plot. Site indices derived from site trees are used to choose the proper mean annual increment curve. The potential cubic foot yield per acre per year is calculated based on the culmination point of the mean annual increment curve. The age at the culmination point is the biological harvest age for producing the maximum amount of wood.

The average potential growth for softwood forest types in Working Circle 1 was estimated to be 79 cubic feet per acre per year. Average potential growth for hardwood forest types was estimated to be 91 cubic feet per acre per year. Average

TABLE 37.
Net annual mortality of sawtimber on commercial timberland
by species and cause of death, Working Circle 1 (thousand board feet Scribner).

Species	Cause of Death						Total (all causes)
	Insects	Disease	Fire	Animal	Weather Suppression thousand board feet	Unknown Logging	
Douglas-fir	1,105	2,340	—	173	528	2,821	7,071
Lodgepole pine	1,958	—	—	—	807	2,513	5,278
Ponderosa pine	1,093	—	—	—	—	646	1,739
Western larch	1,142	2,897	445	—	1,695	497	6,676
Subalpine fir	—	1,690	—	—	365	463	2,518
Grand fir	—	5,197	—	—	485	1,050	7,097
Spruce	478	374	—	—	337	546	2,344
Western redcedar	—	271	—	—	—	—	271
Western hemlock	—	—	—	—	—	—	—
Whitebark pine	—	202	—	—	236	133	571
Western white pine	—	226	—	—	—	351	711
Softwood Species	5,776	13,197	445	173	4,453	9,020	34,276
Aspen	—	—	—	—	—	—	—
Cottonwood	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—
Hardwood Species	—	—	—	—	—	—	—
TOTAL	5,776	13,197	445	173	4,453	9,020	34,276

potential growth for all forest types was estimated to be 79 cubic feet (see table 38).

Gross growth for softwood forest types in Working Circle 1 was estimated to be 50 cubic feet per acre per year, or about 63 percent of potential growth. When a forest is composed of stands in many age

classes, a gap between gross growth and potential growth should be expected. However, a large gap between gross growth and potential growth may indicate that management opportunities exist to increase growth. Studying the forest's growth-related physical characteristics should suggest ways to reduce this gap.

TABLE 38.
Average potential productivity per acre by
forest type for commercial timberland, Working Circle 1.

Forest Type	Average Potential Productivity (cubic feet/acre/year)
Douglas-fir	75
Lodgepole pine	78
Ponderosa pine	75
Western larch	88
Subalpine fir-spruce	70
Grand fir	102
Spruce	90
Western redcedar	90
Western hemlock	137
Whitebark pine	38
Western white pine	140
Juniper	51
All Softwood types	79
Aspen	136
Cottonwood	54
Mixed hardwoods	73
All hardwood types	91
ALL FOREST TYPES	79

Insects and Disease

Insects and disease were weakening trees on 580,300 acres or 37 percent of the commercial timberland in 1977. Both the growth (vigor) of a forest and the mortality rate are affected by the amount of insect and disease activity. At the time of measurement, mistletoe was found on more acres than any other insect or disease problem. Mistletoe was most prev-

alent in sawtimber stands, especially old growth sawtimber (see table 39). Rot, the second most common problem, also occurred most frequently in sawtimber stands.

Damaging insects were most prevalent in poletimber stands. Two of the more common groups of damaging insects are bark beetles and defoliators. Defoliating insects like spruce budworm rarely kill a tree but are detrimental because they reduce

TABLE 39.
Area of commercial timberland by stand size class and
insect and disease category, Working Circle 1 (thousand acres).

	Insect and Disease Category					
Stand Size Class	Unclassified	Bark Beetles	Defoliators	Mistletoe	Rot	Total
	thousand acres					
Old Growth Sawtimber	198.9	25.0	4.3	94.2	59.2	381.6
Young Growth Sawtimber	326.7	37.7	8.3	89.0	73.8	535.5
Poletimber	174.4	41.4	23.1	32.8	5.4	277.1
Seedlings and Saplings	284.1	10.0	7.3	37.1	27.5	366.0
Nonstocked	16.4	—	—	1.3	2.9	20.6
TOTAL	1,000.5	114.1	43.0	254.4	168.8	1,580.8

the tree's growth rate. In contrast, bark beetles usually kill a tree when they attack in large numbers.

Existing Stand Structure

Distribution by Stand Size Class

Distribution by stand size class data show that young-growth sawtimber stands dominate in Working Circle 1. Sawtimber stands occurred on 58 percent of the commercial forest acreage at the time of sampling. Only 20,600 acres, or 1.3 percent of all timberlands in the working circle, were found to be nonstocked (see figure 6).

Other private lands had the least sawtimber acreage; sawtimber stands covered only 50 percent of these lands. Only about 5 percent of the other private lands carried old-growth sawtimber stands (see table 40).

Distribution by Stand Age Class

Distribution by stand age class data showed that forests in Working Circle 1 were generally rather young. Stands 41 to 100 years old covered 58 percent, or 904,900 acres of the total softwood acreage (see table 41). Only 29 percent of

all softwood forest stands were found to be over 100 years old.

The other private ownership group had an especially large amount of its acreage in young stands. Stands 41 to 100 years old were found on 79 percent of the commercial softwood acreage. Only 35,700 acres or 8 percent of the other private lands contained softwood stands estimated to be over 100 years old.

Distribution by Stand Volume Class

Most stands of timber in Working Circle 1 fell into the lower stand volume classes. Overall, 53 percent of the commercial timberland carried less than 5,000 board feet Scribner per acre. Stands in the higher volume classes, which carried at least 10,000 board feet per acre, occurred on only 347,600 acres, or 22 percent of the commercial timberlands in the working circle (see table 42).

Other private lands contained very few high-volume stands of timber. Only 11 percent of the commercial stands on these lands contained 10,000 or more board feet per acre. Stands with less than 5,000 board feet per acre occurred on 68 percent of the other private ownership group's commercial timberland (see figure 7).

FIGURE 6. Area of commercial timberland by stand size class, Working Circle 1.

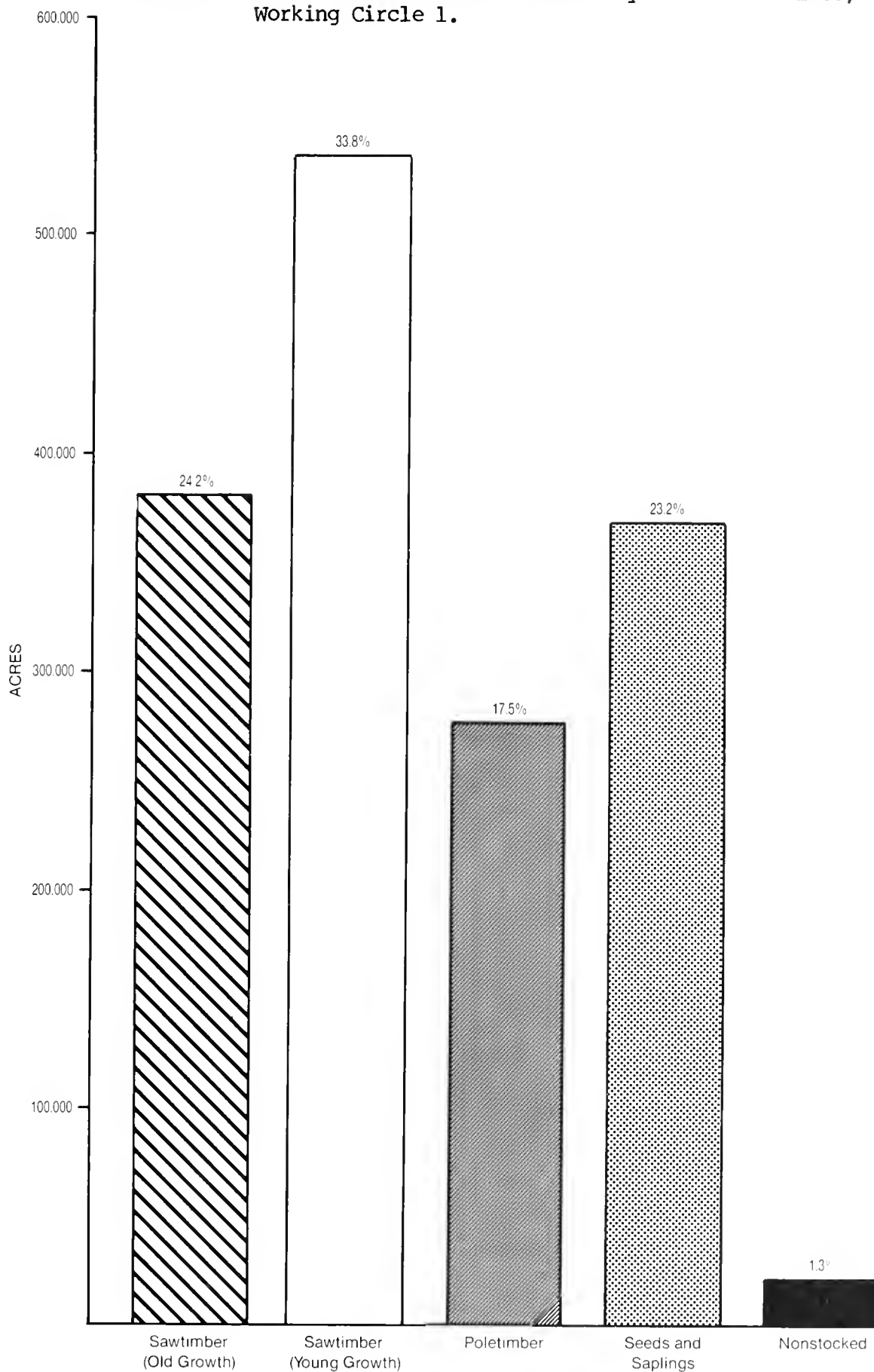


TABLE 40.
Area of commercial timberland by ownership group, stand size class, and
stocking percent class, Working Circle 1 (thousand acres).

Ownership Group	Stocking Percent Class						Total	
	59 or less (understocked)		60-132		133 or more (overstocked)			
	thousand acres							
State and Other Public	%		%		%		%	
Old growth sawtimber	8.3	3.0	76.6	27.3	14.1	5.0	99.0	35.3
Young growth sawtimber	5.8	2.1	59.9	21.3	17.4	6.2	83.1	29.6
Poletimber	4.4	1.6	18.5	6.6	20.2	7.2	43.1	15.4
Seedlings and saplings	4.1	1.4	34.8	12.4	12.4	4.4	51.3	18.2
Nonstocked	4.3	1.5	—	0.0	—	0.0	4.3	1.5
TOTAL	26.9	9.6	189.8	67.6	64.1	22.8	280.9	100.0
Forest Industry	%		%		%		%	
Old growth sawtimber	35.3	4.3	193.8	23.7	30.1	3.7	259.2	31.7
Young growth sawtimber	34.3	4.2	174.2	21.3	26.1	3.2	234.6	28.7
Poletimber	13.3	1.6	59.4	7.2	51.9	6.3	124.6	15.1
Seedlings and saplings	66.6	8.1	102.4	12.5	20.0	2.4	189.0	23.0
Nonstocked	12.0	1.5	—	0.0	—	0.0	12.0	1.5
TOTAL	161.5	19.7	529.8	64.7	128.1	15.6	819.4	100.0
Other Private	%		%		%		%	
Old growth sawtimber	1.2	0.2	18.0	3.8	4.2	0.9	23.4	4.9
Young growth sawtimber	45.6	9.5	150.6	31.3	21.6	4.5	217.8	45.3
Poletimber	12.3	2.6	77.0	16.0	20.2	4.2	109.5	22.8
Seedlings and saplings	18.9	3.9	86.0	17.9	20.7	4.3	125.6	26.1
Nonstocked	4.3	0.9	—	0.0	—	0.0	4.3	0.9
TOTAL	82.3	17.1	331.6	69.0	66.7	13.9	480.6	100.0
Total for Working Circle	%		%		%		%	
Old growth sawtimber	44.8	2.8	288.4	18.3	48.4	3.1	381.6	24.2
Young growth sawtimber	85.7	5.4	384.7	24.3	65.1	4.1	535.5	33.8
Poletimber	30.0	1.9	154.9	9.8	92.3	5.8	277.2	17.5
Seedlings and saplings	89.6	5.7	223.2	14.1	53.1	3.4	365.9	23.2
Nonstocked	20.6	1.3	—	0.0	—	0.0	20.6	1.3
TOTAL	270.7	17.1	1,051.2	66.5	258.9	16.4	1,580.8	100.0

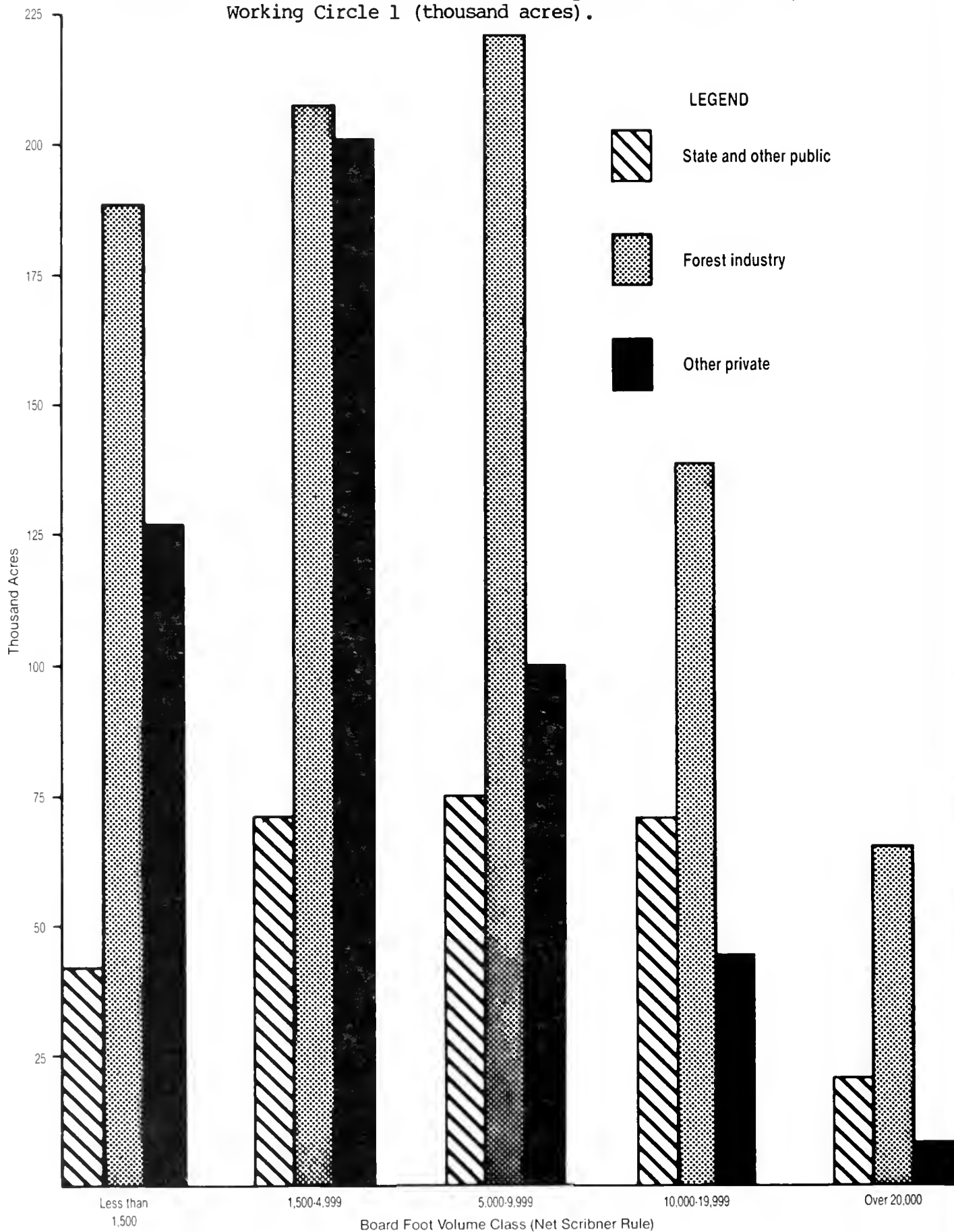
TABLE 41.
Area of commercial softwood timberland by stand age class and
ownership group, Working Circle 1 (thousand acres).

Stand Age Class	Ownership Group						Total	
	State and Other Public		Forest Industry		Other Private			
	thousand acres							
	%		%		%		%	
Unclassified	4.8	1.7	24.8	3.0	4.3	0.9	33.9	2.2
1 - 20	17.9	6.4	47.2	5.8	5.5	1.2	70.6	4.5
21 - 40	10.4	3.7	34.1	4.2	51.4	11.1	95.9	6.1
41 - 60	45.7	16.3	58.4	7.1	99.0	21.4	203.1	13.0
61 - 80	48.3	17.3	194.6	23.8	180.1	39.0	423.0	27.1
81 - 100	48.3	17.3	144.2	17.6	86.3	18.7	278.8	17.9
101 - 120	24.9	8.9	115.8	14.1	21.6	4.7	162.3	10.4
121 - 140	36.3	13.0	86.5	10.6	8.5	1.8	131.3	8.4
141 - 160	17.7	6.3	48.4	5.9	5.6	1.2	71.7	4.6
161 - 180	12.8	4.6	13.1	1.6	—	0.0	25.9	1.7
181 - 200	10.0	3.5	21.6	2.6	—	0.0	31.6	2.0
201 +	2.8	1.0	30.0	3.7	—	0.0	32.8	2.1
TOTAL	279.9	100.0	818.7	100.0	462.3	100.0	1,560.9	100.0

TABLE 42.
Area of commercial timberland by stand volume class
and ownership group, Working Circle 1 (thousand acres).

Board Foot/Acre Volume Class Net Scribner Rule	Ownership Group							Total
	State and Other Public		Forest Industry		Other Private			
	thousand acres							
	%	%	%	%				
Less than 1,500	42.4	15.0	188.4	23.0	127.0	26.4	357.8	22.6
1,500 - 4,999	71.6	25.5	207.1	25.3	200.8	41.8	479.5	30.3
5,000 - 9,999	75.2	26.8	220.9	27.0	99.8	20.8	395.9	25.1
10,000 - 19,999	70.9	25.3	138.6	16.9	44.6	9.3	254.1	16.1
Over 20,000	20.7	7.4	64.4	7.8	8.4	1.7	93.5	5.9
TOTAL	280.8	100.0	819.4	100.0	480.6	100.0	1,580.8	100.0

FIGURE 7. Area of commercial forest land by stand volume class, Working Circle 1 (thousand acres).



Stocking

Stocking is a qualitative term used to describe the "degree of adequacy" of a stand in a particular condition to meet a certain timber management objective (Gingrich 1964). Table 40 shows an assessment of the forest's stocking for producing board-foot volume by displaying the amount of area in each stocking percent class. Stocking percent is the amount of space available to one live tree on a given acre compared to the amount of space necessary for optimum yield, measured as a percentage. The amount of space needed for optimum yield depends on tree size and site quality. Consequently, the desired amount of space will vary from one sampled acre to the next (Farrenkopf 1967).

There are three stocking percent classes: less than 60 percent stocked (understocked), 60 to 132 percent stocked, and greater than 132 percent stocked (overstocked). Each field plot can be up to 167 percent stocked, since each individual sample point of the ten point cluster can be up to 16.7 percent stocked (10 points x 16.7 percent stocking per point = 167 percent stocking per field plot), depending on the size and number of trees present. A stocking percent class rating of 100 percent is equivalent to 60 percent of the basal area listed by a normal yield table. A normal yield table shows the maximum volume, number of trees, and basal area that a given site can support at a given age (Davis 1966). A stocking percent class rating of 132 percent is equivalent to 80 percent of the basal area listed by a normal yield table. Volume predictions made by normal yield tables are for fully stocked stands grown under "natural" conditions without competition and do not predict the yield that could be captured from a given site if managed. It is believed that a range of stocking between 60 and 100 percent of the normal yield table basal area is the range within which the full board-foot growth potential of a forest acre can be realized. Theoretically, trees in this stocking range are beginning to fully use the site and growth per acre is not reduced by overcrowding.

Table 40 shows that, at the time of sampling, about one-third of the commercial timberland in Working Circle 1 was improperly stocked for realizing its full board-foot growth potential. Of these lands, approximately 270,700 acres were understocked and 258,900 acres were overstocked. Many of the overstocked pole-timber and seedling-sapling stands, jointly covering about 145,400 acres, represented potential thinning opportunities.

Basal Area by Diameter Class

The basal area by diameter class for the average acre of commercial softwood forest land in 1977 is displayed in figures 9, 10, 11, 12, 13, and 14 by owner group. On the basis of trees in the 20-84 site class, lands owned by the other private group exhibited the lowest basal area per acre, with an average of 70 square feet per acre. State and other publicly owned land exhibited the highest basal area per acre--90 square feet. The same trend was evident in the 85 plus productivity classes. Lands owned by the other private group exhibited the lowest basal area per acre--92 square feet--while state and other public lands exhibited the highest basal area per acre--116 square feet per acre.

Figure 8 shows the expected basal area per acre by diameter class curve for an average acre of forest land if the forest land base were brought under full management and were fully regulated. When regulated, the forest would consist of many individual stands of trees with different ages and sizes. All of these different stands, viewed as one, will give the appearance of a forest managed by the selection method. The shape of the desired curve is based on a theoretical situation where the forest is fully regulated and a variety of round-wood materials (pulp, poles, and saw logs) are product objectives (Green 1976). The basal area in trees less than 10 inches d.b.h. should be about 40 percent of the basal area in trees 10 inches d.b.h. and larger, or about 30 percent of the total basal area (Green 1976). The desired amount of basal area stocking under the curve is the average level of stocking which should be

FIGURE 8. Example of the shape of the desired average basal area per acre by diameter class curve providing a variety of round-wood materials are product objectives. (The amount of basal area depicted by the curve is dependent on the management regime and the productivity of the land to produce wood.)

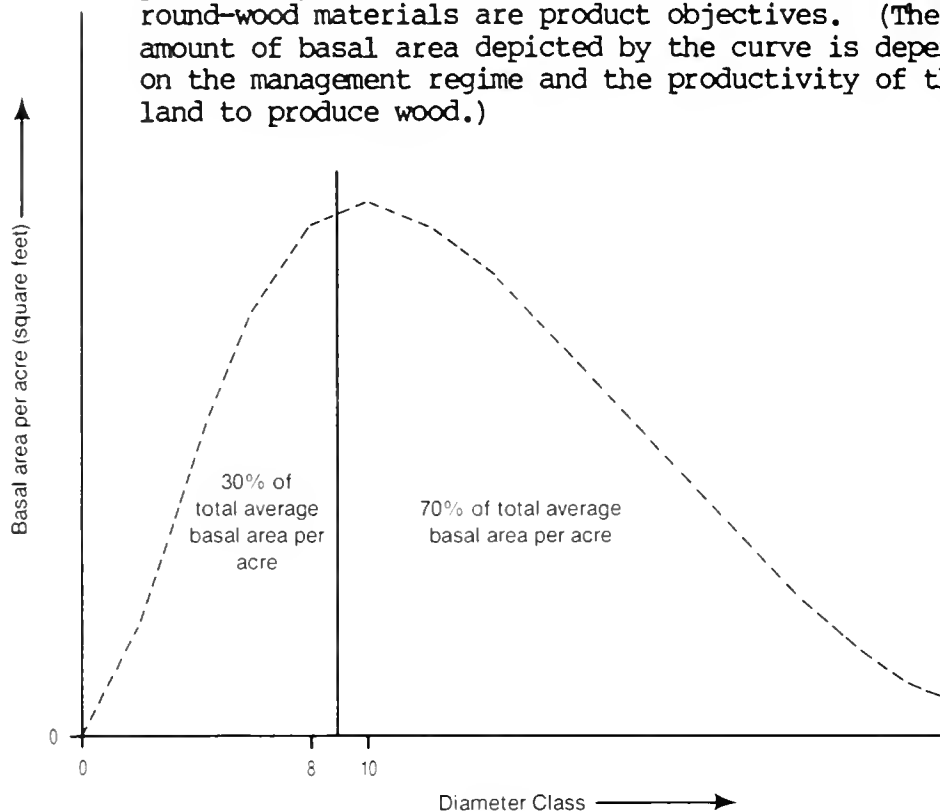


FIGURE 9. Current average basal area per acre by diameter class for softwood forest types for productivity class 20-84, state and other public, Working Circle 1.

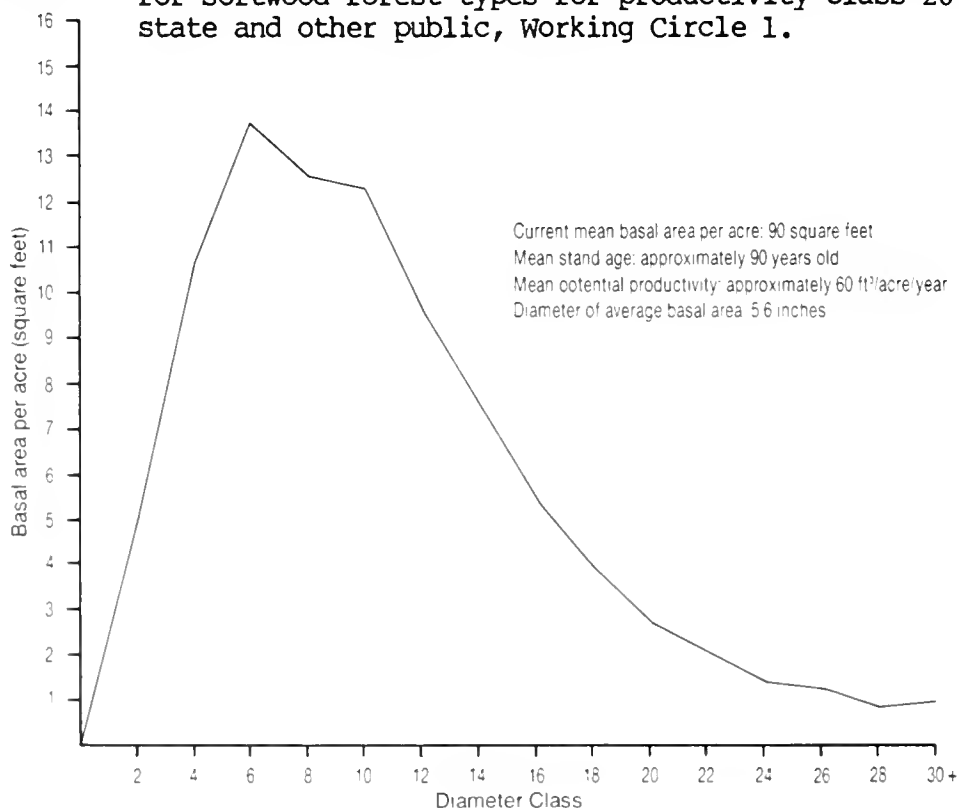


FIGURE 10. Current average basal area per acre by diameter class for softwood forest types for productivity class 85+, state and other public, Working Circle 1.

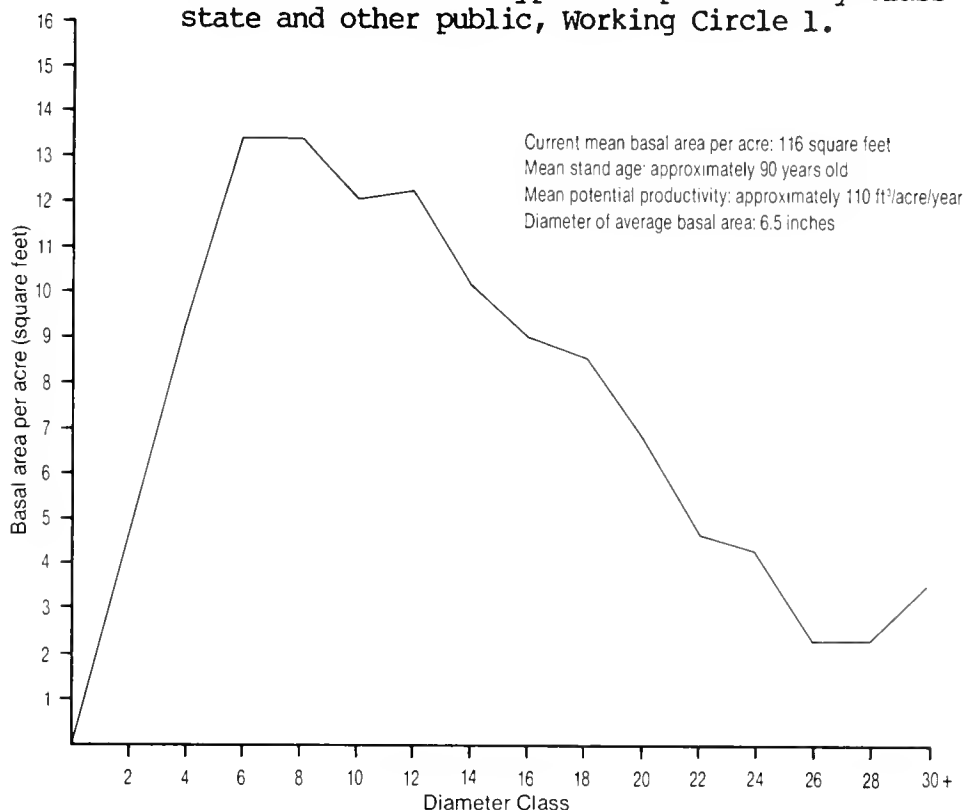


FIGURE 11. Current average basal area per acre by diameter class for softwood forest types for productivity class 20-84, forest industry, Working Circle 1.

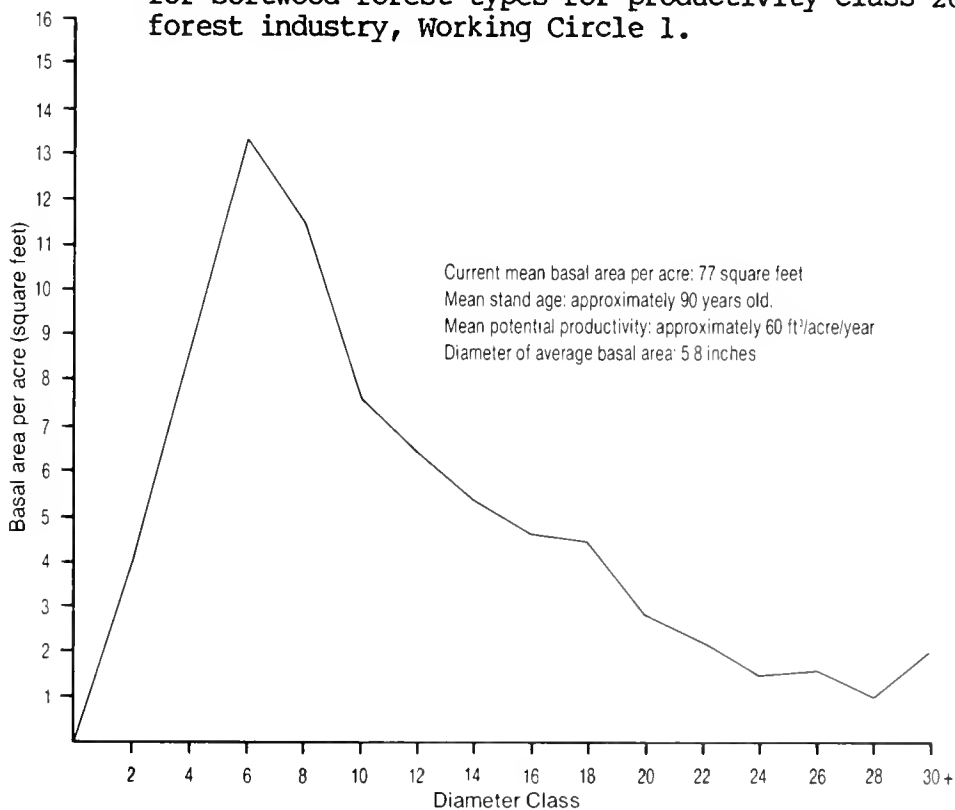


FIGURE 12. Current average basal area per acre by diameter class for softwood forest types for productivity class 85+, forest industry, Working Circle 1.

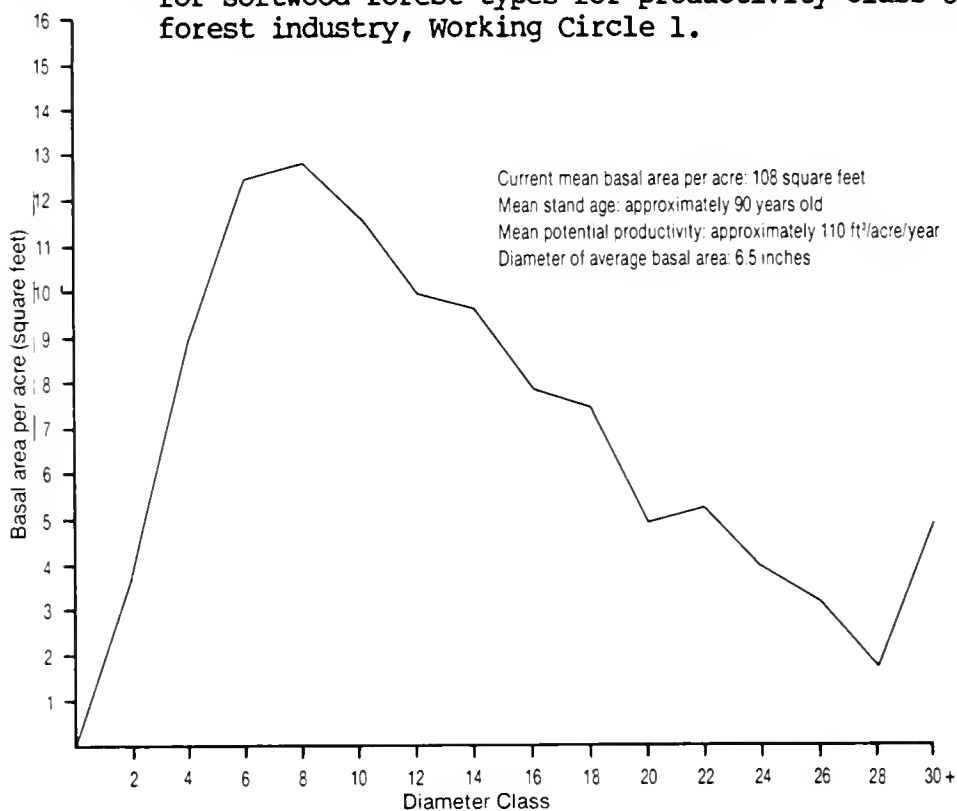


FIGURE 13. Current average basal area per acre by diameter class for softwood forest types for productivity class 20-84, other private, Working Circle 1.

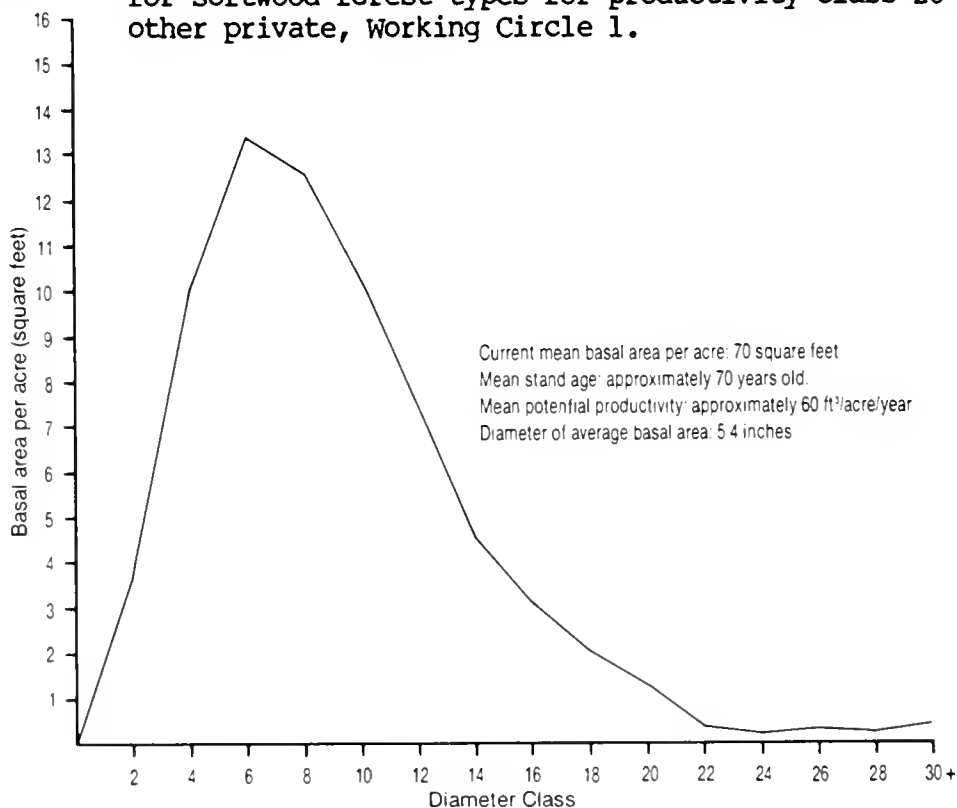
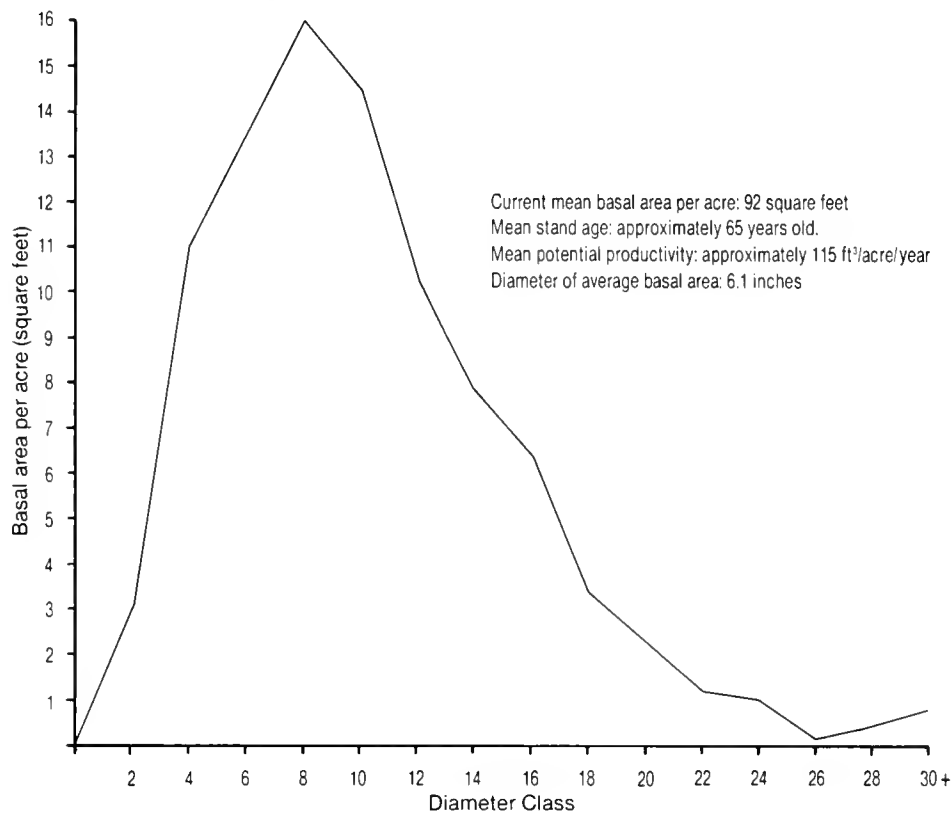


FIGURE 14. Current average basal area per acre by diameter class for softwood forest types for productivity class 85+, other private, Working Circle 1.



carried over the life of the stand. Under intensive management, the stand would be allowed to grow to a higher basal area per acre stocking level than desired. It then would be thinned back to a level below the desired stocking level. This process might be repeated several times until the stand is finally harvested. Under an uneven-aged management scheme, certain trees in a stand would be harvested on a periodic basis but the desired average basal area per acre would still be maintained.

Examining the distribution of total basal area per acre at the time of sampling (table 54, page 86) shows that only forest industry and state and other public lands on sites with basal areas of 85 cubic feet per acre or better were even close to the recommended stocking distribution as shown in figure 8. Lands owned by the other private group, in partic-

ular, were heavily unbalanced towards the smaller diameter classes.

At first glance, the percentage of basal area below 10 inches d.b.h. would indicate that thinning is needed to balance out the diameter distribution. This would probably be true if the average acre were stocked at or above the desired amount.

TABLE 43.
MAI Site Class
(cubic feet/acre/year)

Ownership Group	20-84	85+
State and other public	47%	35%
Forest industry	49%	35%
Other private	57%	47%

Unfortunately, this does not appear to be the case when the average stand age, site class, and forest type composition of the forest represented by each curve are taken into account. All the sites appear to have been understocked, especially when compared to basal area standard tables.* The degree to which these sites were understocked varies according to the management regime, which is chosen to achieve the objectives of the land owner or manager.

If the average forest acre is understocked, the average amount of basal area per acre below 10 inches d.b.h. may actually be low. The amount of basal area in some of the smaller diameter classes may be near or slightly below the desired stocking levels. Thinning opportunities would still be available, but at a level below the initial estimate. Evidence of understocking would indicate that there are areas where stocking needs to be increased through regeneration of understocked areas or by silvicultural treatments that will increase net growth.

The graphs in figures 9 through 14 represent a one-point-in-time picture of the average basal area per acre by diameter class. The key to developing timber management strategies based on these graphs is to know the direction and rate of change occurring within each diameter class. Estimates concerning the changes or dynamics of the forest can best be made by analyzing remeasurement data. Unfortunately, such data are not available at this time.

TIMBERLAND QUALITY CLASS

Timberland quality classes are used to rate commercial timberlands according to their relative value for producing timber. The rankings are based primarily on factors that indicate the operability and

*For example, according to basal area standard tables for western larch (derived from Schmidt et al. 1976), 80-year-old stands on MAI sites of 60 cubic feet per acre per year should have a basal area stocking of 132 square feet per acre. Stands on MAI sites of 110 cubic feet per acre per year should have a basal area stocking of 157 square feet per acre.

productivity of the forest. In this inventory, four quality classes--excellent, good, fair, and poor--were used. To avoid confusing the findings of this timberland rating effort with those of other states and federal land management agencies, the term "prime timberlands" was not used.

Class Definitions

The criteria used to place timberlands into the appropriate quality classes are as follows:

Excellent timberlands:

- have a potential productivity that is ≥ 85 cubic feet per acre per year
- have a slope that is ≤ 40 percent
- have a good (class I) or medium (class II) landscape stability rating
- are $\leq 7,000$ feet in elevation (west of the Continental Divide)

Good timberlands:

- do not meet the requirements for excellent timberlands
- have a potential productivity that is ≥ 50 cubic feet per acre per year
- have a good (class I) or medium (class II) landscape stability rating
- have a slope that is ≤ 40 percent if potential productivity is < 85 cubic feet per acre per year
- are $\leq 7,000$ feet in elevation (west of the Continental Divide)

Fair timberlands:

- do not meet the requirements for good or excellent timberlands
- have a potential productivity that is ≥ 20 cubic feet per acre per year
- have a slope that is ≤ 56 percent
- have a good (class I) or medium (class II) landscape stability rating
- are $\leq 8,000$ feet in elevation

Poor timberlands:

- do not meet the requirements for excellent, good, or fair timberlands

Timberland Quality Class and Stand Size Class

Seventy-five percent of the softwood timberlands in Working Circle 1 are rated as either excellent or good for timber production, while only 5 percent are rated as poor.

Sawtimber stands occupied 732,200 acres of good or excellent rated timberland. These same acres had 6,019,000,000 board feet of volume (see appendix 1, table 113).

Most — 55 percent — of the 1,064,700 acres of softwood timberland rated as excellent or good for timber production are owned by the forest industries. Only 2 percent — 19,000 acres — of forest industry lands are rated as poor (see table 44). Eighty-two percent of the other private lands in the working circle are rated as excellent or good for producing timber.

SILVICULTURAL TREATMENT OPPORTUNITIES

The Forestry Division has developed a procedure for using forest inventory data to assess silvicultural treatment opportunities. As a part of this procedure, 12 treatment opportunity categories were selected; each one represents a group of stands with similar characteristics. Each category was given a treatment code number and a treatment name, such as "20 -- Precommercial thinning."

Despite its appearance, a treatment name does not prescribe a treatment—it is merely a label for a group of stands that exhibit common characteristics; these characteristics differentiate one group of stands from another. Although these labels have a silvicultural basis, the limited amount of stand data used to derive these categories restricts the use of the process to planning.

To some degree, the treatment names used here reflect the forest management policies of the Forestry Division; different stand conditions and forestry goals demand different management techniques. Other forest managers might apply different names to these categories, or possibly combine two or more of them under a single heading, depending on their management objectives.

Treatment Code Definitions

Table 45 lists the treatment opportunities and their code numbers. The list is divided into three groups. The first consists of the individual treatments. The other two list possible combined treatments. Combined treatment opportunities or combination codes are of two types: those that won't overlap and those that may. The combined codes listed under the "possible overlap" grouping represent treatments that may overlap each other during actual treatment. For example, the combined treatment code--13, 20, 22--suggests that a certain stand needs a treatment, or treatments, that will remove the overstory (13), precommercially thin (20), and sanitize the stand (22). Two or more of these needs might be met in one step. Sanitation may be partially met by precommercial thinning, or it may be partially or completely met by removing the overstory.

Understanding that some treatments may be handled simultaneously is important when allocating funds, equipment, and manpower for timber stand improvement projects. Estimates of costs and work loads may be reduced for acreages on which treatments may overlap.

For further information about the kinds of stands represented by each treatment code, see appendix 5.

Treatment Opportunities by Ownership Group and Site Class

Four codes indicate no immediate treatments are needed. These are: (11) harvest-low risk, (30) no treatment due to productive condition, (33) no treatment, deferred until merchantable, and (40) unknown--poor crowns, good growth. In Working Circle 1, approximately 467,300 acres, or about 30 percent of the unit's commercial softwood timberlands, were placed into these treatment categories (see table 57). An additional 276,500 acres were placed into the harvest-high risk category, and 6,400 acres were classified as inoperable (32). The remaining 810,700 acres, or 52 percent of the commercial softwood timberlands, were placed into categories that imply that silvicultural

TABLE 44.
Area of commercial softwood timberland by stand size
class and timberland quality class by ownership group,
Working Circle 1 (thousand acres).

	Timberland Quality Class				
	Excellent	Good	Fair	Poor	Total
State and Other Public	thousand acres				
Stand Size Class					
Old Growth Sawtimber	27.0	36.9	25.3	9.5	98.7
Young Growth Sawtimber	39.0	28.3	8.9	6.4	82.5
Poletimber	12.9	16.5	5.8	7.9	43.1
Seedlings and Saplings	15.2	20.1	9.6	6.4	51.3
Nonstocked	—	1.6	1.3	1.4	4.3
TOTAL	94.0	103.3	51.0	31.6	279.9
Forest Industry					
Stand Size Class					
Old Growth Sawtimber	76.0	130.0	44.0	8.9	258.9
Young Growth Sawtimber	95.7	93.8	44.1	0.7	234.3
Poletimber	21.7	52.4	46.2	4.3	124.6
Seedlings and Saplings	21.8	86.7	75.4	5.1	189.0
Nonstocked	4.4	4.7	2.9	—	12.0
TOTAL	219.5	367.5	212.6	19.0	818.7
Other Private					
Stand Size Class					
Old Growth Sawtimber	4.4	8.2	9.6	0.6	22.8
Young Growth Sawtimber	111.8	81.4	7.7	7.1	207.9
Poletimber	40.7	49.1	16.0	—	105.8
Seedlings and Saplings	25.1	59.1	25.8	11.5	121.5
Nonstocked	—	0.6	3.7	—	4.3
TOTAL	182.0	198.4	62.7	19.2	462.3
Working Circle Totals					
Stand Size Class					
Old Growth Sawtimber	107.3	175.1	78.8	19.1	380.3
Young Growth Sawtimber	246.4	203.4	60.8	14.2	524.7
Poletimber	75.2	117.9	68.0	12.3	273.5
Seedlings and Saplings	62.1	165.9	110.8	23.0	361.7
Nonstocked	4.4	6.9	7.9	1.4	20.6
TOTAL	495.5	669.2	326.3	69.8	1,560.9

tural treatment opportunities are available. If stands in the harvest-high risk category (10) are added, the total amount of commercial softwood timberland that could use some type of silvicultural treatment becomes 1,087,200 acres, or 70 percent of all softwood timberlands inventoried.

This does not mean that all of these acres should be treated. Because of the costs involved and possible nontimber resource considerations, it may not be advisable to apply the indicated treatments to some stands. Nevertheless, this total acreage figure is important because it helps to illustrate the overall condition of the forest. It also partially explains why current net growth in the working circle averages 37 cubic feet per acre per year less than potential net growth. These opportunities can be viewed with optimism if forest managers plan to take advantage of them to increase the health and vigor (productivity) of the forest.

State and other public lands offer fewer treatment opportunities than forest industry and other private lands. About 63 percent of the public lands offered some type of treatment opportunity, while an estimated 70 percent of the other private lands and 72 percent of the forest industry lands offered treatment opportunities.

If lands in the harvest-high risk category (10) are subtracted from the total number of acres offering silvicultural treatment opportunities, an estimate of the number of acres offering treatment opportunities other than harvesting can be made. Such a calculation would show that 51 percent--415,800 acres--of forest industry land, 62 percent--287,400 acres--of other private land, and 39 percent--107,700 acres--of state and other public lands offered treatment opportunities in addition to harvesting. The amount of land placed in the different treatment opportunity groups is shown for the working circle as a whole, as well as for each of the different land ownership groups, in tables 46 through 49. These tables also show the number of acres in each treatment opportunity group that fall within the different productivity site classes.

Silvicultural Treatment Opportunities by Timberland Quality Class

Forest managers usually consider a stand's potential economic return before applying silvicultural treatments. Potential productivity and operability of the land are important factors in determining the possible economic return realized from forest management activities. Therefore, a table that estimates acreage by timberland quality class and treatment opportunity class can be helpful by showing how many acres are likely to be economical to treat. Obviously, timber management funds are more likely to be spent on timberlands rated as good or excellent than on timberlands of lesser quality.

The amounts of land in the different timberland quality classes that were assigned to the different treatment opportunities are shown in table 50. These acreages are shown for the working circle as a whole, as well as for the different ownership groups.

In Working Circle 1, the treatment opportunity with the largest amount of good or excellent quality timberland at the time of the inventory was harvest-low risk. This treatment opportunity existed on 268,700 acres of these highly productive lands. Another 218,000 acres of high quality land was in the harvest-high risk category.

As shown in the table, large amounts of high quality land also fell into four other treatment opportunity categories:

- 23 — regeneration of understocked areas (91,800 acres)
- 22 — sanitation (64,500 acres)
- 20 — precommercial thinning (60,900 acres)
- 30 — no treatment due to productive condition (59,300 acres)

The next three most common treatment opportunities included different combinations of the same treatments--precommercial thinning (20), sanitation (22), and overstory removal (13). These groups are:

- 13, 20, 22 — overstory removal, precommercial thinning, and sanitation (50,300 acres)

TABLE 45.
Treatment opportunity code definitions
for tables 46, 47, 48, and 49.

10	Harvest - high risk
11	Harvest - low risk
12	Commercial thinning
13	Overstory removal
20	Precommercial thinning
21	Stand conversion
22	Sanitation
23	Regeneration of understocked areas
30	No treatment due to productive condition
32	No treatment inoperable
33	No treatment deferred until merchantable
40	Unknown - poor crowns, good growth

No Overlap

12, 13	Commercial thinning, overstory removal
13, 20	Overstory removal, precommercial thinning
13, 20, 23	Overstory removal, precommercial thinning, regeneration of understocked areas
13, 21	Overstory removal, stand conversion
13, 23	Overstory removal, regeneration of understocked areas
13, 33	Overstory removal, no treatment deferred until merchantable
20, 23	Precommercial thinning, regeneration of understocked areas
22, 23	Sanitation, regeneration of understocked areas
22, 33	Sanitation, no treatment deferred until merchantable

Possible Overlap

12, 13, 22	Commercial thinning, overstory removal, sanitation
12, 22	Commercial thinning, sanitation
13, 20, 22	Overstory removal, precommercial thinning, sanitation
13,20,22,23	Overstory removal, precommercial thinning, sanitation, regeneration of understocked areas
13, 22	Overstory removal, sanitation
13, 22, 23	Overstory removal, sanitation, regeneration of understocked areas
13, 22, 33	Overstory removal, sanitation, no treatment deferred until merchantable
20, 22	Precommercial thinning, sanitation
20, 22, 23	Precommercial thinning, sanitation, regneration of understocked areas

TABLE 46.
Area of commercial softwood timberland by site class and
treatment opportunity group, Working Circle 1 (thousand acres).

Treatment Opportunity	Site Class (cubic feet/acre/year)					Total
	20-49	50-84	85-119	120-164	165+	
	thousand acres					
10	29.9	134.7	86.3	25.6	—	276.5
11	19.8	180.9	119.4	14.1	8.5	342.6
12	—	—	5.9	—	—	5.9
13	—	18.6	9.5	—	4.2	32.3
20	23.8	35.3	29.6	5.8	0.8	95.4
21	15.4	34.5	10.1	4.2	1.4	65.7
22	12.7	48.2	22.0	9.5	—	92.3
23	31.6	63.1	30.3	5.8	—	130.9
30	8.6	26.6	34.7	10.9	—	80.9
32	1.4	4.3	0.7	—	—	6.4
33	1.3	9.9	—	4.0	—	15.2
40	—	18.5	10.1	—	—	28.6
12, 13	—	—	—	—	—	—
13, 20	3.8	38.9	2.1	—	—	44.8
13, 20, 23	1.4	0.6	—	—	—	2.0
13, 21	—	10.0	—	4.3	—	14.3
13, 23	8.5	10.0	10.1	—	—	28.7
13, 33	4.3	7.8	—	—	—	12.0
20, 23	5.8	23.2	2.0	—	—	31.0
22, 23	4.4	9.2	5.6	—	—	19.2
22, 33	4.3	5.9	—	—	—	10.1
12, 13, 22	—	5.7	4.3	—	—	10.0
12, 22	—	—	8.7	8.6	—	17.3
13, 20, 22	—	34.4	10.4	5.4	—	50.3
13, 20, 22, 23	—	—	—	—	—	—
13, 22	9.2	13.9	13.6	—	—	36.7
13, 22, 23	4.3	8.0	8.6	—	—	20.9
13, 22, 33	—	—	—	4.3	—	4.3
20, 22	10.0	21.1	27.1	1.4	—	59.7
20, 22, 23	—	8.8	6.0	12.3	—	27.1
TOTAL	200.4	772.2	457.0	116.3	15.0	1,560.9

TABLE 47.
Area of commercial softwood timberland by site class
and treatment opportunity group, state and other public
ownership group, Working Circle 1 (thousand acres).

Treatment Opportunity	Site Class (cubic feet/acre/year)					Total
	20-49	50-84	85-119	120-164	165+	
	thousand acres					
10	6.3	35.9	17.2	8.4	—	67.8
11	6.0	42.0	30.7	4.6	0.1	83.4
12	—	—	1.5	—	—	1.5
13	—	6.0	1.4	—	*	7.5
20	3.9	0.4	5.0	1.4	0.8	11.5
21	3.6	4.2	1.4	*	1.4	10.7
22	0.1	5.1	4.0	1.5	—	10.8
23	3.0	5.1	2.5	1.5	—	12.0
30	—	0.9	7.3	1.6	—	9.8
32	1.4	4.3	0.7	—	—	6.4
33	0.3	1.5	—	0.1	—	1.8
40	—	1.5	1.5	—	—	3.0
12, 13	—	—	—	—	—	—
13, 20	*	4.3	2.1	—	—	6.4
13, 20, 23	1.4	0.6	—	—	—	2.0
13, 21	—	1.4	—	—	—	1.4
13, 23	—	1.4	1.4	—	—	2.8
13, 33	0.1	3.3	—	—	—	3.4
20, 23	1.3	1.4	2.0	—	—	4.8
22, 23	—	2.2	1.3	—	—	3.5
22, 33	—	1.5	—	—	—	1.5
12, 13, 22	—	1.4	—	—	—	1.4
12, 22	—	—	—	—	—	—
13, 20, 22	—	6.3	2.1	1.5	—	9.9
13, 20, 22, 23	—	—	—	—	—	—
13, 22	0.5	1.5	5.1	—	—	7.0
13, 22, 23	—	0.7	0.1	—	—	0.8
13, 22, 33	—	—	—	—	—	—
20, 22	1.3	4.2	1.9	1.4	—	8.8
20, 22, 23	—	—	*	0.1	—	0.1
TOTAL	29.2	137.2	89.1	22.1	2.3	279.9

*Indicates less than 50 acres.

TABLE 48.
Area of commercial softwood timberland by site class
and treatment opportunity group, forest industry ownership
group, Working Circle 1 (thousand acres).

Treatment Opportunity	Site Class (cubic feet/acre/year)					Total
	20-49	50-84	85-119	120-164	165+	
	thousand acres					
10	18.0	78.2	60.5	17.2	—	173.9
11	13.2	103.9	60.4	8.9	4.3	190.7
12	—	—	—	—	—	—
13	—	0.3	4.3	—	—	4.6
20	11.5	26.3	4.3	4.4	—	46.6
21	7.5	20.2	8.7	—	—	36.5
22	8.7	22.1	9.0	—	—	39.8
23	24.4	37.7	9.5	—	—	71.7
30	8.6	13.3	2.9	0.3	—	25.1
32	—	—	—	—	—	—
33	0.3	4.3	—	—	—	4.6
40	—	8.6	—	—	—	8.6
12, 13	—	—	—	—	—	—
13, 20	—	17.8	—	—	—	17.8
13, 20, 23	—	—	—	—	—	—
13, 21	—	8.6	—	4.3	—	12.9
13, 23	8.5	8.7	8.7	—	—	25.9
13, 33	—	4.4	—	—	—	4.4
20, 23	4.4	11.6	—	—	—	16.0
22, 23	4.4	0.7	4.3	—	—	9.4
22, 33	4.3	—	—	—	—	4.3
12, 13, 22	—	4.3	4.3	—	—	8.6
12, 22	—	—	8.7	8.6	—	17.3
13, 20, 22	—	18.8	4.4	—	—	23.2
13, 20, 22, 23	—	—	—	—	—	—
13, 22	8.7	4.3	8.5	—	—	21.5
13, 22, 23	4.3	—	4.3	—	—	8.6
13, 22, 33	—	—	—	4.3	—	4.3
20, 22	4.4	13.0	11.9	—	—	29.3
20, 22, 23	—	8.8	—	4.3	—	13.1
TOTAL	131.2	416.1	214.8	52.2	4.3	818.7

TABLE 49.
Area of commercial softwood timberland by site class
and treatment opportunity group, other private ownership
group, Working Circle 1 (thousand acres).

Treatment Opportunity	Site Class (cubic feet/acre/year)					Total
	20-49	50-84	85-119	120-164	165+	
	thousand acres					
10	5.6	20.6	8.6	—	—	34.8
11	0.6	35.0	28.2	0.6	4.2	68.6
12	—	—	4.4	—	—	4.4
13	—	12.2	3.8	—	4.2	20.2
20	8.5	8.6	20.3	—	—	37.4
21	4.3	10.1	—	4.2	—	18.6
22	3.9	20.9	8.9	8.0	—	41.8
23	5.4	19.3	18.1	4.4	—	47.2
30	—	12.9	24.4	8.7	—	45.9
32	—	—	—	—	—	—
33	0.6	4.2	—	3.9	—	8.7
40	—	8.3	8.6	—	—	16.9
12, 13	—	—	—	—	—	—
13, 20	3.8	16.7	—	—	—	20.5
13, 20, 23	—	—	—	—	—	—
13, 21	—	—	—	—	—	—
13, 23	—	—	—	—	—	—
13, 33	4.2	—	—	—	—	4.2
20, 23	—	10.2	—	—	—	10.2
22, 23	—	6.3	—	—	—	6.3
22, 33	—	4.4	—	—	—	4.4
12, 13, 22	—	—	—	—	—	—
12, 22	—	—	—	—	—	—
13, 20, 22	—	9.3	3.9	3.9	—	17.2
13, 20, 22, 23	—	—	—	—	—	—
13, 22	—	8.1	—	—	—	8.1
13, 22, 23	—	7.3	4.2	—	—	11.5
13, 22, 33	—	—	—	—	—	—
20, 22	4.3	3.9	13.4	—	—	21.6
20, 22, 23	—	—	6.0	7.9	—	13.9
TOTAL	41.1	218.4	152.8	41.7	8.4	462.3

TABLE 50.
Area of commercial softwood timberland by treatment
opportunity group, timberland quality class, and ownership group,
Working Circle 1 (thousand acres).

Working Circle Total Treatment Opportunity	Timberland Quality Class				
	Excellent	Good	Fair	Poor	Total
	thousand acres				
10	90.4	127.6	48.6	10.0	276.5
11	122.2	146.5	56.0	17.9	342.6
12	4.4	—	1.4	—	5.9
13	13.7	18.6	—	—	32.3
20	26.8	34.1	28.2	6.3	95.4
21	15.8	20.2	28.4	1.3	65.7
22	20.8	43.7	24.5	3.4	92.3
23	30.9	60.9	35.6	3.4	130.9
30	41.4	17.9	17.2	4.3	80.8
32	—	—	—	6.4	6.4
33	4.0	8.5	1.4	1.3	15.2
40	10.1	18.5	—	—	28.6
12, 13	—	—	—	—	—
13, 20	0.7	37.5	5.2	1.4	44.8
13, 20, 23	—	0.6	1.4	—	2.0
13, 21	4.3	10.0	—	—	14.3
13, 23	10.1	9.4	8.5	0.7	28.7
13, 33	—	5.9	6.1	—	12.0
20, 23	2.0	13.3	14.3	1.4	31.0
22, 23	5.6	8.0	1.2	4.4	19.2
22, 33	—	5.8	4.3	—	10.1
12, 13, 22	4.3	5.7	—	—	10.0
12, 22	17.3	—	—	—	17.3
13, 20, 22	15.8	34.5	—	—	50.3
13, 20, 22, 23	—	—	—	—	—
13, 22	7.1	9.9	18.2	1.5	36.7
13, 22, 23	4.3	8.0	8.6	—	20.9
13, 22, 33	4.3	—	—	—	4.3
20, 22	22.9	19.7	12.7	4.4	59.7
20, 22, 23	16.5	4.4	4.4	1.7	27.0
TOTAL	495.5	669.2	326.3	69.8	1,560.9

TABLE 50. (cont'd.)

State and Other Public Treatment Opportunity	Timberland Quality Class				Total
	Excellent	Good	Fair	Poor	
	thousand acres				
10	21.4	28.8	12.1	5.6	67.8
11	29.4	35.0	12.2	6.8	83.4
12	—	—	1.4	—	1.5
13	1.4	6.0	—	—	7.5
20	6.3	0.1	3.9	1.2	11.5
21	2.9	2.9	3.6	1.3	10.7
22	4.4	1.6	2.2	2.5	10.8
23	3.8	3.9	1.9	2.5	12.0
30	7.9	0.4	1.4	—	9.8
32	—	—	—	6.4	6.4
33	0.1	—	1.4	0.3	1.8
40	1.5	1.5	—	—	3.0
12, 13	—	—	—	—	—
13, 20	0.7	3.0	1.3	1.4	6.4
13, 20, 23	—	0.6	1.4	—	2.0
13, 21	—	1.4	—	—	1.4
13, 23	1.4	0.7	—	0.7	2.8
13, 33	—	1.5	1.9	—	3.4
20, 23	2.0	—	1.3	1.4	4.8
22, 23	1.3	1.8	0.3	—	3.5
22, 33	—	1.5	—	—	1.5
12, 13, 22	—	1.4	—	—	1.4
12, 22	—	—	—	—	—
13, 20, 22	3.5	6.3	—	—	9.9
13, 20, 22, 23	—	—	—	—	—
13, 22	2.8	1.4	1.4	1.5	7.0
13, 22, 23	0.1	0.7	—	—	0.8
13, 22, 33	—	—	—	—	—
20, 22	2.9	2.8	3.0	—	8.8
20, 22, 23	0.1	—	—	—	0.1
TOTAL	94.0	103.3	51.0	31.6	279.9

TABLE 50. (cont'd.)

Forest Industry Treatment Opportunity	Timberland Quality Class				
	Excellent	Good	Fair	Poor	Total
	thousand acres				
10	64.6	78.2	26.7	4.3	173.9
11	60.4	86.6	39.1	4.6	190.7
12	—	—	—	—	—
13	4.3	0.3	—	—	4.6
20	4.4	26.0	15.8	0.3	46.6
21	8.7	7.2	20.5	—	36.5
22	—	21.8	17.7	0.3	39.8
23	9.2	37.7	24.4	0.3	71.7
30	0.3	4.7	15.8	4.3	25.1
32	—	—	—	—	—
33	—	4.3	—	0.3	4.6
40	—	8.6	—	—	8.6
12, 13	—	—	—	—	—
13, 20	—	17.8	—	—	17.8
13, 20, 23	—	—	—	—	—
13, 21	4.3	8.6	—	—	12.9
13, 23	8.7	8.7	8.5	—	25.9
13, 33	—	4.4	—	—	4.4
20, 23	—	7.3	8.7	—	16.0
22, 23	4.3	0.4	0.3	4.4	9.4
22, 33	—	—	4.3	—	4.3
12, 13, 22	4.3	4.3	—	—	8.6
12, 22	17.3	—	—	—	17.3
13, 20, 22	4.4	18.8	—	—	23.2
13, 20, 22, 23	—	—	—	—	—
13, 22	4.3	4.3	12.9	—	21.5
13, 22, 23	—	—	8.6	—	8.6
13, 22, 33	4.3	—	—	—	4.3
20, 22	11.6	13.0	4.7	—	29.3
20, 22, 23	4.3	4.4	4.4	—	13.1
TOTAL	219.5	367.5	212.6	19.0	818.7

TABLE 50. (cont'd.)

Other Private Treatment Opportunity	Timberland Quality Class				Total
	Excellent	Good	Fair	Poor	
	thousand acres				
10	4.4	20.6	9.8	—	34.8
11	32.4	24.9	4.8	6.5	68.6
12	4.4	—	—	—	4.4
13	8.0	12.2	—	—	20.2
20	16.1	8.0	8.5	4.8	37.4
21	4.2	10.1	4.3	—	18.6
22	16.3	20.3	4.5	0.6	41.8
23	17.9	19.3	9.3	0.6	47.2
30	33.1	12.9	—	—	45.9
32	—	—	—	—	—
33	3.9	4.2	—	0.6	8.7
40	8.6	8.3	—	—	16.9
12, 13	—	—	—	—	—
13, 20	—	16.7	3.8	—	20.5
13, 20, 23	—	—	—	—	—
13, 21	—	—	—	—	—
13, 23	—	—	—	—	—
13, 33	—	—	4.2	—	4.2
20, 23	—	6.0	4.2	—	10.2
22, 23	—	5.7	0.6	—	6.3
22, 33	—	4.4	—	—	4.4
12, 13, 22	—	—	—	—	—
12, 22	—	—	—	—	—
13, 20, 22	7.9	9.3	—	—	17.2
13, 20, 22, 23	—	—	—	—	—
13, 22	—	4.2	3.9	—	8.1
13, 22, 23	4.2	7.3	—	—	11.5
13, 22, 33	—	—	—	—	—
20, 22	8.4	3.9	4.9	4.4	21.6
20, 22, 23	12.2	—	—	1.7	13.9
TOTAL	182.0	198.4	62.7	19.2	462.3

20, 22 -- precommercial thinning and sanitation (42,600 acres)
13, 20 -- overstory removal and precommercial thinning (38,200 acres)

Another way to view treatment opportunities is to break the combined treatment codes into their component treatment codes and assign each code the total acreage figure. For example, if 10,000 acres are assigned the "13, 20--overstory removal and precommercial thinning" combined treatment code, then 10,000 acres present opportunities for overstory removal and 10,000 acres present opportunities for precommercial thinning. By adding the acreages assigned to the individual codes it is possible to determine the amount of land offering opportunities for each type of treatment. Table 51 shows the total number of acres assigned to each treatment opportunity class. The table also shows the amounts of land in the different timberland quality classes that were assigned to the different treatment opportunity classes. These amounts are shown for the working circle as a whole, as well as for the different ownership groups.

Because they are not combined with any other treatments, the number of acres in the harvest-high risk and harvest-low risk groups does not change in the treatment class tables. If these "harvest" groups are ignored, the most commonly assigned treatment opportunity classes for excellent and good-rated timberlands in Working Circle 1 were sanitation (258,400 acres), precommercial thinning (228,800 acres), overstory removal (204,600 acres), and regeneration of understocked areas (173,900 acres).

AVAILABLE TIMBER

Every acre of state and private forest land will not be available for continuous timber harvesting. Some of the timber is not now available and probably will never be sold by the owner or harvested unless wood becomes much more valuable than it is now. A difficult and potentially expensive task in any forest inventory, then, is to determine the amount of tim-

ber that is actually available for harvesting.

The first step in assessing timber availability is to group the forest land into availability classes. This is done based on various combinations of land-use influence zones, ownership groups, and topographic characteristics. Some of the criteria used to delineate availability classes include water influence zones, travel influence zones, slope percent, and elevation. These availability classes are then assigned to one of three land classes based on each land class's definition and the characteristics of the different availability classes. Table 52 shows the results of accessing timber availability in Working Circle 1.

Land Classes

The commercial forest land in Working Circle 1 was grouped into three land classes (Green 1976):

1. Standard: land available and operable now that is not subject to any nontimber-use impacts that might affect timber growing costs or expected yields.
2. Special: land available and operable now, but with ecological or other use constraints that might affect the cost of growing timber, expected yield or both; and
3. Marginal: land potentially available and operable, or both, but not now expected to be harvested because of excessive development costs, low product returns, or resource protection constraints.

Availability Classes

An availability class was designated for the different types of land included in each land class. Using standard land as Availability Class I, where full yields can be expected to be available, other availability classes were defined as a percentage of the standard land yields expected, considering the impacts of other uses.

In this manner, it was possible to estimate the amount that timber yields would be reduced because of nontimber use constraints. For Working Circle 1, this

TABLE 51.
Area of commercial softwood timberland by treatment
class, timberland quality class, and ownership group,
Working Circle 1 (thousand acres).

Stand Treatment Class	Ownership Group Timberland Quality Class				Total
	Excellent	Good	Fair	Poor	
	thousand acres				
Working Circle Total					
Harvest-high risk	90.4	127.6	48.6	9.9	276.5
Harvest-low risk	122.2	146.5	56.0	17.9	342.6
Commercial thinning	26.0	5.7	1.5	—	33.2
Overstory removal	64.5	140.1	48.1	3.5	256.2
Precommercial thinning	84.7	144.1	66.0	15.3	310.1
Stand conversion	20.1	30.2	28.4	1.3	80.0
Sanitation	118.7	139.7	73.9	15.5	347.8
Regeneration of understocked areas	69.4	104.5	74.1	11.7	259.7
No treatment due to productive condition	41.4	18.0	17.2	4.3	80.9
No treatment-inoperable	—	—	—	6.4	6.4
No treatment-deferred until merchantable	8.3	20.3	11.8	1.2	41.6
Unknown-poor crowns good growth	10.1	18.5	—	—	28.6
State and Other Public					
Harvest-high risk	21.4	28.8	12.1	5.6	67.8
Harvest-low risk	29.4	35.0	12.2	6.8	83.4
Commercial thinning	—	1.4	1.4	—	2.9
Overstory removal	10.0	23.1	6.0	3.5	42.6
Precommercial thinning	15.5	12.8	11.0	4.0	43.4
Stand conversion	2.9	4.3	3.6	1.3	12.1
Sanitation	15.2	17.6	7.0	4.0	43.7
Regeneration of understocked areas	8.8	7.7	5.0	4.6	26.0
No treatment due to productive condition	7.9	0.4	1.4	—	9.8
No treatment-inoperable	—	—	—	6.4	6.4
No treatment-deferred until merchantable	0.1	3.0	3.4	0.3	6.7
Unknown-poor crowns good growth	1.5	1.5	—	—	3.0

TABLE 51. (cont'd.)

Stand Treatment Class	Timberland Quality Class				
	Excellent	Good	Fair	Poor	Total
	thousand acres				
Forest Industry					
Harvest-high risk	64.6	78.2	26.7	4.3	173.9
Harvest-low risk	60.4	86.6	39.1	4.6	190.7
Commercial thinning	21.5	4.3	—	—	25.8
Overstory removal	34.5	67.3	30.1	—	131.9
Precommercial thinning	24.7	87.3	33.7	0.3	146.0
Stand conversion	13.0	15.8	20.5	—	49.4
Sanitation	54.6	67.0	53.0	4.7	179.3
Regeneration of understocked areas	26.4	58.5	55.0	4.7	144.7
No treatment due to productive condition	0.3	4.7	15.8	4.3	25.1
No treatment-inoperable	—	—	—	—	—
No treatment-deferred until merchantable	4.3	8.7	4.3	0.3	17.6
Unknown-poor crowns good growth	—	8.6	—	—	8.6
Other Private					
Harvest-high risk	4.4	20.6	9.8	—	34.8
Harvest-low risk	32.4	24.9	4.8	6.5	68.6
Commercial thinning	4.4	—	—	—	4.4
Overstory removal	20.1	49.7	11.9	—	81.7
Precommercial thinning	44.5	44.0	21.3	10.9	120.7
Stand conversion	4.2	10.1	4.3	—	18.6
Sanitation	48.9	55.2	13.9	6.7	124.7
Regeneration of understocked areas	34.3	38.3	14.1	2.3	89.0
No treatment due to productive condition	33.1	12.9	—	—	46.0
No treatment-inoperable	—	—	—	—	—
No treatment-deferred until merchantable	3.9	8.6	4.2	0.6	17.3
Unknown-poor crowns good growth	8.6	8.3	—	—	16.9

TABLE 52.
Availability class definitions and components.

Land Class	Availability Class	Percentage of Standard Land Yield Expected	Class Definitions
Standard	I	100	Standard land definition
Special	II	90	Big game winter range areas; travel and municipal influence zones
	III	75	Ski resort, recreation, and subdivision influence zones
	IV	70	Water influence zones and the other private-individual ownership class
	VI	0	Subdivided land; state administered land other than state classified forest land and state classified grazing land
Marginal	V	50	Steep slopes ($\geq 56\%$); all land $\geq 7,000$ feet in elevation; all land with a slope stability class rating of III (poor)

amount proved to be equivalent to reducing the commercial forest land area by 17 percent.

Table 53 shows the amount of land in each land class.

TABLE 53.
Area of commercial timberland by land class,
availability class and productivity class,
Working Circle 1 (thousand acres).

Availability Class	Productivity Class cubic feet/acre/year	Land Class			Total
		Standard	Special	Marginal	
		thousand acres			
I	20 - 49	53.7	—	—	53.7
	50 - 84	179.7	—	—	179.7
	85 - 119	100.9	—	—	100.9
	120 - 164	24.1	—	—	24.1
	165 +	2.5	—	—	2.5
	TOTAL	360.9	—	—	360.9
II	20 - 49	—	97.0	—	97.0
	50 - 84	—	330.7	—	330.7
	85 - 119	—	185.4	—	185.4
	120 - 164	—	47.1	—	47.1
	165 +	—	4.4	—	4.4
	TOTAL	—	664.6	—	664.6
III	20 - 49	—	3.6	—	3.6
	50 - 84	—	13.2	—	13.2
	85 - 119	—	8.0	—	8.0
	120 - 164	—	2.2	—	2.2
	165 +	—	0.2	—	0.2
	TOTAL	—	27.2	—	27.2
IV	20 - 49	—	42.6	—	42.6
	50 - 84	—	210.8	—	210.8
	85 - 119	—	137.5	—	137.5
	120 - 164	—	43.5	—	43.5
	165 +	—	6.8	—	6.8
	TOTAL	—	441.2	—	441.2
V	20 - 49	—	—	7.7	7.7
	50 - 84	—	—	28.7	28.7
	85 - 119	—	—	16.5	16.5
	120 - 164	—	—	4.0	4.0
	165 +	—	—	0.5	0.5
	TOTAL	—	—	57.4	57.4
VI	20 - 49	—	2.3	—	2.3
	50 - 84	—	13.4	—	13.4
	85 - 119	—	10.0	—	10.0
	120 - 164	—	3.2	—	3.2
	165 +	—	0.6	—	0.6
	TOTAL	—	29.5	—	29.5
GRAND TOTAL		360.9	1,162.5	57.4	1,580.8

INVENTORY DATA BY COUNTY

AREA BY OWNERSHIP GROUP

The four counties that make up Working Circle 1 exhibit great differences in area and ownership patterns (see table 54). A fifth of Flathead County, the largest in the working circle, lies in Glacier National Park. Lake County, the smallest county in the working circle, contains the most Indian land. Nearly a third of the county's area is BIA land, and another third is other private land. Lake County also contains the smallest amount of Forest Service land. In contrast, just over half of both Sanders and Flathead counties is owned by the Forest Service, while three-fourths of Lincoln County is Forest Service land.

As shown in table 55, the percentage of land owned by the forest industries in each of Flathead and Sanders counties is nearly the same as they own in the working circle as a whole. Forest industries own much less land in Lake County and much more in Lincoln County. The percentage of other private lands in Flathead and Sanders counties is about the same as it is in the working circle as a whole. This figure is much higher in Lake County and much lower in Lincoln County.

Figure 15 shows the proportion of the sampled commercial timberland owned by the different ownership groups. In each county, forest industries own the most sampled commercial timberland. The state and other public group owns the least. As shown in the figure, forest industries own nearly two-thirds of the sampled commercial timberland in Lincoln County, but only about a third of that sampled in Lake County. A fourth of the commercial timberland sampled in Lincoln County and about a third of that sampled in each of the other counties are owned by the other private group.

Sanders County contains almost half of the noncommercial forest land in Working

Circle 1 (see table 56). Most of the non-commercial forest land in Lake and Sanders counties is owned by the other private group. In Flathead and Lincoln counties, most of the noncommercial forest land is state and other public land.

FOREST TYPE ACREAGE BY OWNERSHIP GROUP

The Douglas-fir forest type was clearly predominant in Working Circle 1 at the time of the inventory (see tables 57 through 60). This type occurred on nearly half of the commercial timberlands and covered more than twice as many acres as lodgepole pine, the second most common type.

FOREST TYPE VOLUME BY OWNERSHIP GROUP

Just as Douglas-fir was the most common forest type, it also contained the highest board-foot and cubic-foot volumes of timber (see tables 61 through 68). In Sanders County, the Douglas-fir type contained a greater volume of timber than all the other forest types combined (see figure 16). The western larch type contained the second highest board-foot volume of timber in every county except Sanders, where it ranked fifth in board-foot volume. The lodgepole pine type contained the second highest cubic-foot volume in each county. Flathead County, as would be expected by its size, contained the highest volume of timber--40 percent of the working circle's total board-foot and cubic-foot volumes.

SPECIES VOLUME BY OWNERSHIP GROUP

Not surprisingly, Douglas-fir contained the highest board-foot and cubic-foot

TABLE 54.
Total land area by ownership group and county, Working Circle 1 (acres).

Ownership Group	County									
	Flathead		Lake		Lincoln		Sanders		Total	
	Acreage	%	Acreage	%	Acreage	%	Acreage	%	Acreage	%
Public:										
Glacier National Park	643,103	19.6	—	—	—	—	—	—	643,103	7.7
USDI Bureau of Indian Affairs	8,897	0.3	286,086	29.0	—	—	227,076	12.8	522,059	6.2
USDA Forest Service	1,794,545	54.5	163,001	17.0	1,762,378	75.0	912,265	51.3	4,632,189	55.3
Miscellaneous Federal	2,551	0.1	10,607	1.1	—	—	9,846	0.6	23,004	0.3
State	138,143	4.2	64,970	6.8	68,929	3.0	66,287	3.7	338,329	4.1
County and municipal	1,130	*	770	0.1	220	*	150	*	2,270	*
Subtotal	2,588,369	78.7	525,434	54.9	1,831,527	78.0	1,215,624	68.4	6,160,954	73.6
Private:										
Forest Industry	286,109	8.7	69,479	7.3	324,181	13.8	209,267	11.8	889,036	10.6
Other Private	413,138	12.6	361,375	37.8	192,658	8.2	352,837	19.8	1,320,008	15.8
Subtotal	699,247	21.3	430,854	45.1	516,839	22.0	562,104	31.6	2,209,044	26.4
TOTAL	3,287,616	100.0	956,288	100.0	2,348,366	100.0	1,777,728	100.0	8,369,998	100.0

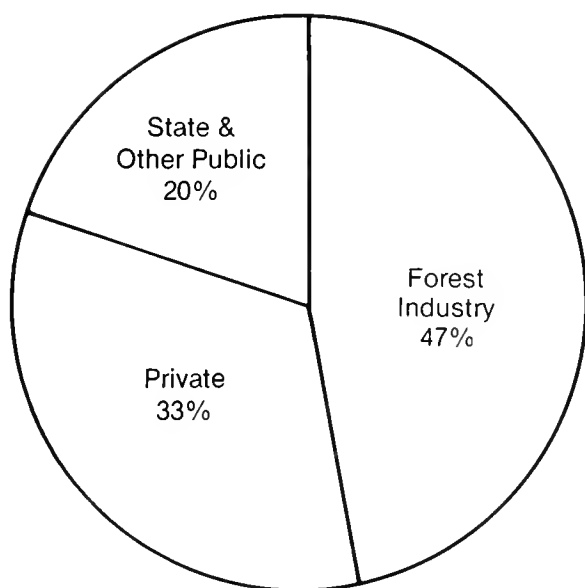
*Less than 0.05 percent.

TABLE 55.
Sampled land area by ownership group and county, Working Circle 1 (acres).

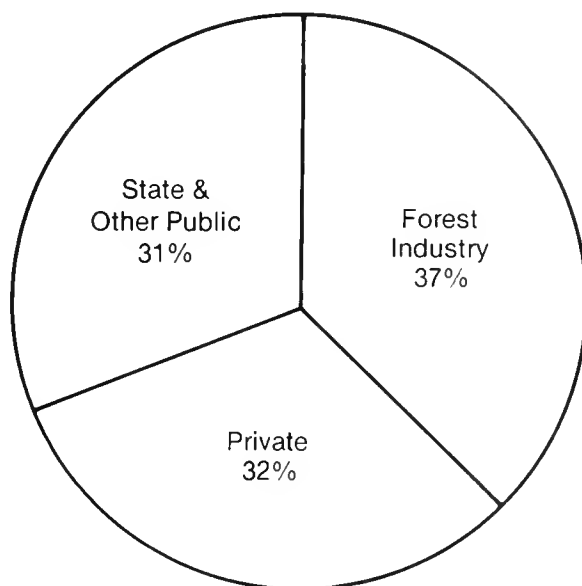
Ownership Group	County									
	Flathead		Lake		Lincoln		Sanders		Total	
	Acreage	%	Acreage	%	Acreage	%	Acreage	%	Acreage	%
State	138,143	16.4	64,970	12.8	68,929	11.8	66,287	10.4	338,329	13.1
County and municipal	1,130	0.2	770	0.2	220	*	150	*	2,270	0.1
Miscellaneous federal	2,551	0.3	10,607	2.1	—	—	9,846	1.5	23,004	0.9
Forest industry	286,109	34.0	69,479	13.7	324,181	55.3	209,267	32.8	889,036	34.6
Private	413,138	49.1	361,375	71.2	192,658	32.9	352,837	55.3	1,320,008	51.3
TOTAL	841,071	100.0	507,201	100.0	585,988	100.0	638,387	100.0	2,572,647	100.0

*Less than 0.05 percent.

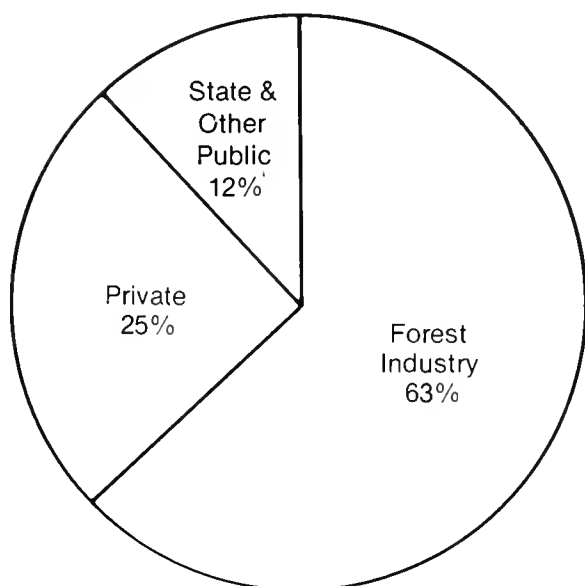
FIGURE 15. Proportion of sampled commercial forest land by ownership group for each county.



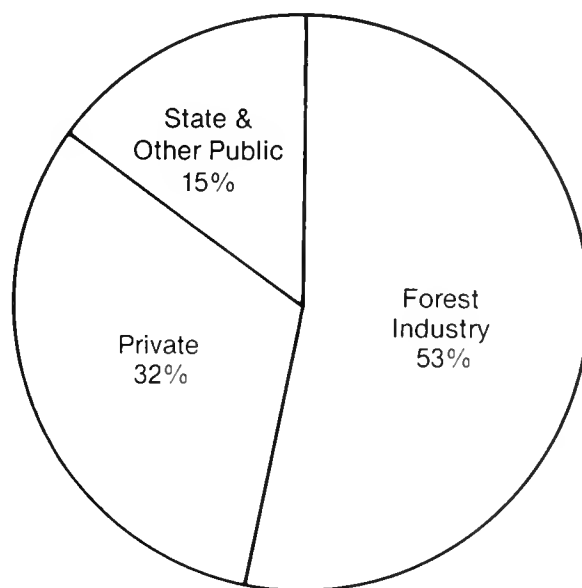
Flathead



Lake



Lincoln



Sanders

TABLE 56.
Area of commercial and other timberland by county
and ownership group, Working Circle 1 (thousand acres).

Ownership Group	Commercial Timberland	Other Timberland	Total Timberland
	-----thousand acres-----		
Flathead County			
State and other public	118.4	1.2	119.6
Forest industry	273.2	0.2	273.4
Other private	194.1	0.9	195.0
TOTAL	585.8	2.4	588.2
Lake County			
State and other public	54.0	0.2	54.3
Forest industry	63.7	*	63.7
Other private	54.8	1.7	56.6
TOTAL	172.7	2.0	174.7
Lincoln County			
State and other public	57.7	1.5	59.2
Forest industry	304.6	0.7	305.3
Other private	123.0	1.1	124.1
TOTAL	485.3	3.3	488.6
Sanders County			
State and other public	50.6	0.2	50.8
Forest industry	177.9	1.5	179.3
Other private	108.7	4.4	113.1
TOTAL	337.0	6.1	343.1
WORKING CIRCLE TOTAL	1,580.8	13.8	1,594.6

*Less than 50 acres.

TABLE 57.
Area of commercial timberland by forest type and ownership group,
Flathead County, Working Circle 1 (thousand acres).

Forest Type	Ownership Group			Total	
	State and Other Public	Forest Industry	Other Private		
	thousand acres				
Douglas-fir	36.3	108.3	96.5	241.1	41.2%
Lodgepole pine	25.2	67.0	31.8	124.0	21.2
Ponderosa pine	1.9	22.5	9.6	34.0	5.8
Western larch	14.2	26.8	18.3	59.3	10.1
Subalpine fir-spruce	29.9	16.4	6.6	52.9	9.0
Grand fir	4.8	16.7	4.8	26.3	4.5
Spruce	3.6	6.9	13.3	23.8	4.1
Western redcedar	*	6.9	2.5	9.4	1.6
Western hemlock	*	1.5	2.1	3.6	0.6
Whitebark pine	2.2	—	—	2.2	0.4
Western white pine	0.1	—	2.4	2.5	0.4
Juniper	—	—	—	—	—
Softwood types	118.2	273.0	187.9	579.1	98.9
Aspen	—	—	1.9	1.9	0.3
Cottonwood	0.3	0.1	1.6	2.0	0.3
Mixed hardwoods	—	—	2.8	2.8	0.5
Hardwood types	0.3	0.1	6.3	6.7	1.1
ALL FOREST TYPES	118.5	273.1	194.2	585.8	100.0

*Less than 50 acres.

TABLE 58.
Area of commercial timberland by forest type and ownership group,
Lake County, Working Circle 1 (thousand acres).

Forest Type	Ownership Group			Total	
	State and Other Public	Forest Industry	Other Private		
	thousand acres				
Douglas-fir	19.5	40.0	21.9	81.4	47.2%
Lodgepole pine	5.3	9.3	5.0	19.6	11.4
Ponderosa pine	1.7	4.0	14.0	19.7	11.4
Western larch	10.2	2.4	4.2	16.8	9.7
Subalpine fir-spruce	3.8	1.1	0.8	5.7	3.3
Grand fir	5.7	3.4	—	9.1	5.3
Spruce	5.2	2.1	2.2	9.5	5.5
Western redcedar	1.6	—	2.8	4.4	2.5
Western hemlock	—	—	—	—	—
Whitebark pine	0.8	1.3	—	2.1	1.2
Western white pine	—	—	—	—	—
Juniper	—	—	0.5	0.5	0.3
Softwood types	53.8	63.6	51.4	168.8	97.8
Aspen	0.1	—	1.2	1.3	0.7
Cottonwood	0.1	0.1	2.4	2.6	1.5
Mixed hardwoods	—	—	—	—	—
Hardwood types	0.2	0.1	3.6	3.9	2.2
ALL FOREST TYPES	54.0	63.7	55.0	172.7	100.0

TABLE 59.
Area of commercial timberland by forest type and ownership group,
Lincoln County, Working Circle 1 (thousand acres).

Forest Type	Ownership Group			Total	
	State and Other Public	Forest Industry	Other Private		
	thousand acres				
Douglas-fir	25.3	117.7	62.4	205.4	42.3%
Lodgepole pine	12.2	75.8	17.7	105.7	21.8
Ponderosa pine	1.9	29.9	6.8	38.6	8.0
Western larch	6.8	29.4	10.4	46.6	9.6
Subalpine fir-spruce	6.5	18.8	5.4	30.7	6.3
Grand fir	3.8	17.9	3.1	24.8	5.1
Spruce	0.6	6.1	8.5	15.2	3.1
Western redcedar	—	6.0	1.8	7.8	1.6
Western hemlock	—	2.8	1.7	4.5	0.9
Whitebark pine	0.5	—	—	0.5	0.1
Western white pine	*	—	1.5	1.5	0.3
Juniper	—	—	—	—	—
Softwood types	57.6	304.4	119.3	481.3	99.1
Aspen	—	—	1.8	1.8	0.4
Cottonwood	0.1	0.2	0.5	0.8	0.2
Mixed hardwoods	—	—	1.4	1.4	0.3
TOTAL	0.1	0.2	3.7	4.0	0.9
Hardwood types	57.7	304.6	123.0	485.3	100.0

*Less than 50 acres.

TABLE 60.
Area of commercial timberland by forest type and ownership group,
Sanders County, Working Circle 1 (thousand acres).

Forest Type	Ownership Group			Total	
	State and Other Public	Forest Industry	Other Private		
	thousand acres				
Douglas-fir	32.4	118.1	47.3	197.8	58.6%
Lodgepole pine	9.3	21.6	9.1	40.0	11.9
Ponderosa pine	6.5	10.9	29.1	46.5	13.8
Western larch	1.9	5.0	8.9	15.8	4.7
Subalpine fir-spruce	0.2	2.3	0.7	3.2	1.0
Grand fir	—	9.7	—	9.7	2.9
Spruce	0.1	6.9	1.7	8.7	2.6
Western redcedar	—	—	5.8	5.8	1.7
Western hemlock	—	—	—	—	—
Whitebark pine	—	3.0	—	3.0	0.9
Western white pine	—	—	—	—	—
Juniper	—	—	1.2	1.2	0.3
Softwood types	50.4	177.5	103.8	331.7	98.4
Aspen	—	—	3.0	3.0	0.9
Cottonwood	0.2	0.3	1.8	2.3	0.7
Mixed hardwoods	—	—	—	—	—
Hardwood types	0.2	0.3	4.8	5.3	1.6
ALL FOREST TYPES	50.6	177.8	108.6	337.0	100.0

TABLE 61.
Net volume of growing stock on commercial timberland
by forest type and ownership group, Flathead County,
Working Circle 1 (thousand cubic feet).

Forest Type	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	thousand cubic feet				
Douglas-fir	69,807	215,036	112,685	397,528	35.4
Lodgepole pine	62,383	150,125	66,189	278,697	24.8
Ponderosa pine	2,007	34,004	5,800	41,811	3.7
Western larch	41,202	70,813	42,037	154,052	13.7
Subalpine fir-spruce	66,744	22,425	1,989	91,159	8.1
Grand fir	11,484	43,080	7,963	62,526	5.6
Spruce	12,520	13,265	26,381	52,166	4.7
Western redcedar	14	31,242	2,770	34,026	3.0
Western hemlock	33	—	3,190	3,223	0.3
Whitebark pine	2,727	—	—	2,727	0.2
Western white pine	55	—	2,478	2,533	0.2
Juniper	—	—	—	—	—
Softwood types	268,976	579,989	271,482	1,120,447	99.7
Aspen	—	—	1,037	1,037	0.1
Cottonwood	160	125	339	624	0.1
Mixed hardwoods	10	—	1,133	1,142	0.1
Hardwood types	170	125	2,508	2,804	0.3
ALL FOREST TYPES	269,146	580,114	273,990	1,123,251	100.0

TABLE 62.
Net volume of growing stock on commercial timberland
by forest type and ownership group, Lake County,
Working Circle 1 (thousand cubic feet).

Forest Type	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	thousand cubic feet				
Douglas-fir	44,684	54,641	27,154	126,480	44.8
Lodgepole pine	10,612	18,684	11,831	41,127	14.6
Ponderosa pine	1,304	2,253	15,358	18,915	6.7
Western larch	20,824	586	13,711	35,121	12.4
Subalpine fir-spruce	1,353	681	273	2,307	0.8
Grand fir	10,042	4,705	—	14,747	5.2
Spruce	16,733	7,547	1,453	25,734	9.1
Western redcedar	6,172	—	3,309	9,481	3.4
Western hemlock	—	—	—	—	—
Whitebark pine	578	4,810	—	5,389	1.9
Western white pine	—	—	—	—	—
Juniper	—	—	89	89	*
Softwood types	112,304	93,908	73,178	279,389	98.9
Aspen	151	—	2,293	2,444	0.9
Cottonwood	70	31	427	528	0.2
Mixed hardwoods	—	—	—	—	—
Hardwood types	222	31	2,720	2,973	1.1
ALL FOREST TYPES	112,526	93,939	75,898	282,362	100.0

*Less than 0.05 percent.

TABLE 63.
Net volume of growing stock on commercial timberland
by forest type and ownership group, Lincoln County,
Working Circle 1 (thousand cubic feet).

Forest Type	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	thousand cubic feet				
Douglas-fir	47,419	215,530	70,141	333,090	38.8
Lodgepole pine	30,446	151,588	37,124	219,158	25.6
Ponderosa pine	1,940	37,853	3,419	43,213	5.0
Western larch	13,521	72,144	23,848	109,513	12.8
Subalpine fir-spruce	12,063	18,361	1,625	32,049	3.7
Grand fir	11,006	38,796	5,036	54,837	6.4
Spruce	2,201	11,447	16,813	30,461	3.6
Western redcedar	—	26,997	1,983	28,980	3.4
Western hemlock	—	—	2,578	2,578	0.3
Whitebark pine	410	—	—	410	*
Western white pine	4	—	1,567	1,571	0.2
Juniper	—	—	—	—	—
Softwood types	119,011	572,715	164,133	855,859	99.8
Aspen	—	—	966	966	0.1
Cottonwood	100	117	94	311	*
Mixed hardwoods	—	—	568	568	0.1
Hardwood types	100	117	1,628	1,846	0.2
ALL FOREST TYPES	119,111	572,832	165,762	857,705	100.0

*Less than 0.05 percent.

TABLE 64.
Net volume of growing stock on commercial timberland
by forest type and ownership group, Sanders County,
Working Circle 1 (thousand cubic feet).

Forest Type	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	thousand cubic feet				
Douglas-fir	62,038	171,123	58,222	291,382	55.3
Lodgepole pine	21,214	42,525	22,044	85,783	16.3
Ponderosa pine	9,757	7,368	31,916	49,040	9.3
Western larch	1,502	1,321	30,665	33,488	6.4
Subalpine fir-spruce	80	1,302	264	1,645	0.3
Grand fir	—	14,374	—	14,374	2.7
Spruce	76	25,013	1,105	26,193	5.0
Western redcedar	—	—	7,439	7,439	1.4
Western hemlock	—	—	—	—	—
Whitebark pine	—	10,757	—	10,757	2.0
Western white pine	—	—	—	—	—
Juniper	—	—	225	225	*
Softwood types	94,666	273,782	151,878	520,327	98.8
Aspen	—	—	5,672	5,672	1.1
Cottonwood	75	154	369	599	0.1
Mixed hardwoods	—	—	—	—	—
Hardwood types	75	154	6,042	6,271	1.2
ALL FOREST TYPES	94,742	273,936	157,920	526,598	100.0

*Less than 0.05 percent.

TABLE 65.

Net volume of sawtimber on commercial timberland
by forest type and ownership group, Flathead County,
Working Circle 1 (thousand board feet Scribner).

Forest Type	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	thousand board feet				
Douglas-fir	260,152	838,402	271,511	1,370,066	38.9
Lodgepole pine	129,875	274,466	106,798	511,139	14.5
Ponderosa pine	8,328	146,890	12,104	167,322	4.8
Western larch	170,138	273,776	127,727	571,641	16.2
Subalpine fir-spruce	259,505	84,313	5,381	349,199	9.9
Grand fir	38,499	170,329	15,812	224,640	6.4
Spruce	56,309	39,238	72,201	167,748	4.8
Western redcedar	51	121,435	10,304	131,790	3.8
Western hemlock	98	—	9,502	9,601	0.3
Whitebark pine	6,568	—	—	6,568	0.2
Western white pine	111	—	4,959	5,070	0.1
Juniper	—	—	—	—	—
Softwood types	929,635	1,948,849	636,300	3,514,784	99.9
Aspen	—	—	1,141	1,141	*
Cottonwood	460	354	1,141	1,956	0.1
Mixed hardwoods	8	—	988	996	*
Hardwood types	469	354	3,271	4,093	0.1
ALL FOREST TYPES	930,104	1,949,203	639,570	3,518,878	100.0

*Less than 0.05 percent.

TABLE 66.

Net volume of sawtimber on commercial timberland
by forest type and ownership group, Lake County,
Working Circle 1 (thousand board feet Scribner).

Forest Type	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	thousand board feet				
Douglas-fir	169,052	167,310	80,918	417,281	45.4
Lodgepole pine	13,001	34,648	25,642	73,291	8.0
Ponderosa pine	5,140	8,859	56,776	70,776	7.7
Western larch	81,972	1,041	37,642	120,655	13.1
Subalpine fir-spruce	4,922	345	345	5,612	0.6
Grand fir	39,503	17,073	—	56,576	6.1
Spruce	70,873	31,655	5,872	108,400	11.8
Western redcedar	25,287	—	8,680	33,967	3.7
Western hemlock	—	—	—	—	—
Whitebark pine	1,673	21,665	—	23,337	2.5
Western white pine	—	—	—	—	—
Juniper	—	—	207	207	*
Softwood types	411,423	282,595	216,083	910,101	98.9
Aspen	485	—	7,335	7,820	0.9
Cottonwood	206	89	1,494	1,789	0.2
Mixed hardwoods	—	—	—	—	—
Hardwood types	691	89	8,829	9,609	1.1
ALL FOREST TYPES	412,114	282,684	224,912	919,711	100.0

*Less than 0.05 percent.

TABLE 67.

Net volume of sawtimber on commercial timberland
by forest type and ownership group, Lincoln County,
Working Circle 1 (thousand board feet Scribner).

Forest Type	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	thousand board feet				
Douglas-fir	174,811	827,387	170,045	1,172,243	43.6
Lodgepole pine	55,051	278,737	61,401	395,189	14.7
Ponderosa pine	8,134	171,338	6,883	186,355	6.9
Western larch	50,429	282,561	73,944	406,935	15.1
Subalpine fir-spruce	44,216	67,590	4,573	116,379	4.3
Grand fir	38,871	151,274	10,000	200,145	7.5
Spruce	9,390	32,855	44,904	87,148	3.3
Western redcedar	—	103,357	7,374	110,731	4.1
Western hemlock	—	—	7,680	7,680	0.3
Whitebark pine	991	—	—	991	*
Western white pine	8	—	3,136	3,144	0.1
Juniper	—	—	—	—	—
Softwood types	381,900	1,915,098	389,941	2,686,940	99.9
Aspen	—	—	1,063	1,063	*
Cottonwood	285	339	320	944	*
Mixed hardwoods	—	—	496	496	*
Hardwood types	285	339	1,879	2,503	0.1
ALL FOREST TYPES	382,185	1,915,438	391,820	2,689,443	100.0

*Less than 0.05 percent.

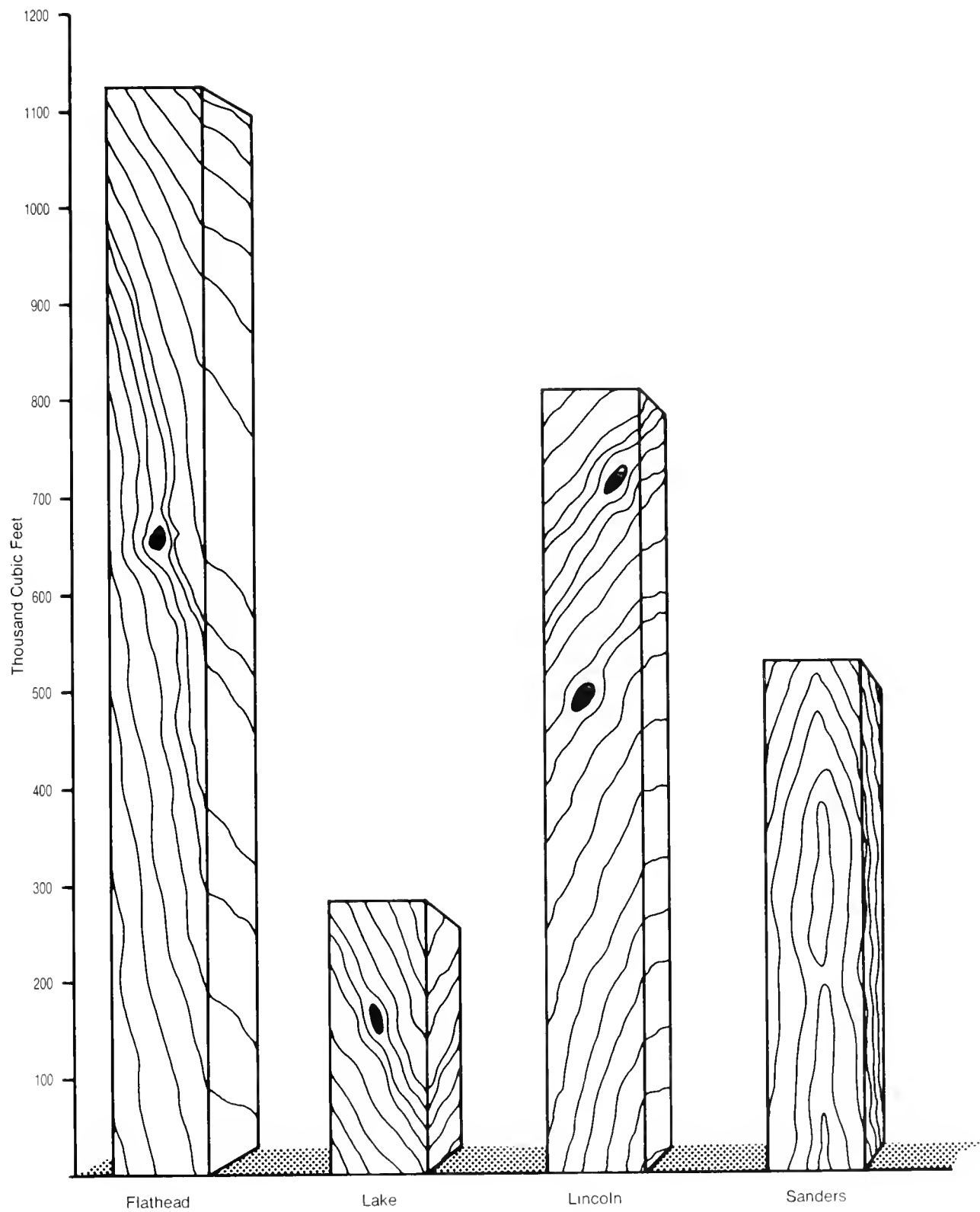
TABLE 68.

Net volume of sawtimber on commercial timberland
by forest type and ownership group, Sanders County,
Working Circle 1 (thousand board feet Scribner).

Forest Type	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	thousand board feet				
Douglas-fir	188,991	526,432	174,340	889,763	56.2
Lodgepole pine	39,694	81,585	49,244	170,523	10.8
Ponderosa pine	36,539	29,417	117,569	183,525	11.6
Western larch	106	2,449	86,902	89,457	5.7
Subalpine fir-spruce	101	741	333	1,175	0.1
Grand fir	—	51,122	—	51,122	3.2
Spruce	308	104,896	4,464	109,668	6.9
Western redcedar	—	—	19,236	19,236	1.2
Western hemlock	—	—	—	—	—
Whitebark pine	—	48,449	—	48,449	3.1
Western white pine	—	—	—	—	—
Juniper	—	—	521	521	*
Softwood types	265,740	845,091	452,608	1,563,439	98.8
Aspen	—	—	18,147	18,147	1.1
Cottonwood	223	452	1,259	1,934	0.1
Mixed hardwoods	—	—	—	—	—
Hardwood types	223	452	19,406	20,081	1.2
ALL FOREST TYPES	265,963	845,543	472,014	1,583,520	100.0

*Less than 0.05 percent.

FIGURE 16. Net volume of growing stock by county.



volumes of timber in each county (see figures 16 and 17). A third of the total volume of timber in Working Circle 1 was in Douglas-fir. Western larch contained the second highest board-foot volume of timber in every county except Sanders, where ponderosa pine ranked second. Lodgepole pine contained the second highest cubic-foot volume in every county except Lake, where western larch ranked second (see tables 69 through 76).

GROWTH AND MORTALITY

As with total volumes, growth and mortality at the time this inventory was conducted were highest in Flathead County. Lake County exhibited the least growth and mortality (see tables 77 through 80).

Tables 81 and 82 show the average growth and mortality per acre in the different counties. Flathead County clearly exhibited the highest growth and mortality per acre. Sanders County showed the lowest mortality per acre and the lowest board-foot growth per acre. The lowest cubic-foot growth per acre occurred in Lake County.

AREA BY SITE CLASS

Table 83 shows the amount of land in each county that fell into the different productivity site classes. Because of their respective sizes, Flathead County contains more acreage in each site class than the other counties, while Lake County has the least. The figures indicate that about 13 percent of the commercial timberlands in each county fell into the lowest productivity site class (20-49 cubic feet per acre per year). They also show that around half of the commercial timberlands in each county fell into the 50-84 cubic feet per acre per year productivity site class. About 42 percent of the commercial timberlands in Lake County fell into the 85+ cubic feet per acre per year site classes and, thus, have the highest potential for producing timber. Thirty-six percent of the commercial timberlands in Lincoln County and 38 percent of those in the

other counties fell into these high site classes. The similarity of these percentage figures indicates that all the counties contain a similar proportion of highly productive lands.

AREA BY HABITAT TYPE

The amount of land in each of the counties occupied by the different habitat types is shown in table 84. The three most productive habitat types in Working Circle 1--THPL/CLUN, ABGR/CLUN, and TSHE/CLUN--occupy 25 percent of the commercial softwood timberlands in the working circle. Just over a fifth of the commercial softwood timberlands in Sanders County, almost a third of those in Lake County, and about a fourth of those in Flathead and Lincoln counties are occupied by these habitat types.

GRAZABLE FOREST LAND DATA

Table 85 shows the area of commercial timberland by understory condition class at the time this inventory was conducted. It shows that Flathead and Lincoln counties had the highest percentage of grazable forest land rated as fair and poor--about 19 percent. Lake and Sanders counties had less than half that percentage of fair- and poor-rated grazable forest land. Most of the fair and poor understory in Flathead and Lincoln counties was in the 0-30 percent crown density class. Grazable forest land with a 31-70 percent crown density was in much better shape.

Grazable forest lands in Flathead County had a higher carrying capacity than those in other counties (see table 86). Those in Lincoln County ranked a close second. These two counties accounted for two-thirds of the total animal unit months (AUMs) available on timberlands in the working circle.

Flathead County also exhibited the greatest potential for increasing carrying capacity. Lincoln County again ranked second (see table 87). If all of the forested rangeland in Flathead County had been in excellent condition, it could have carried almost 22,500 more animal

FIGURE 17. Net volume of sawtimber by county.

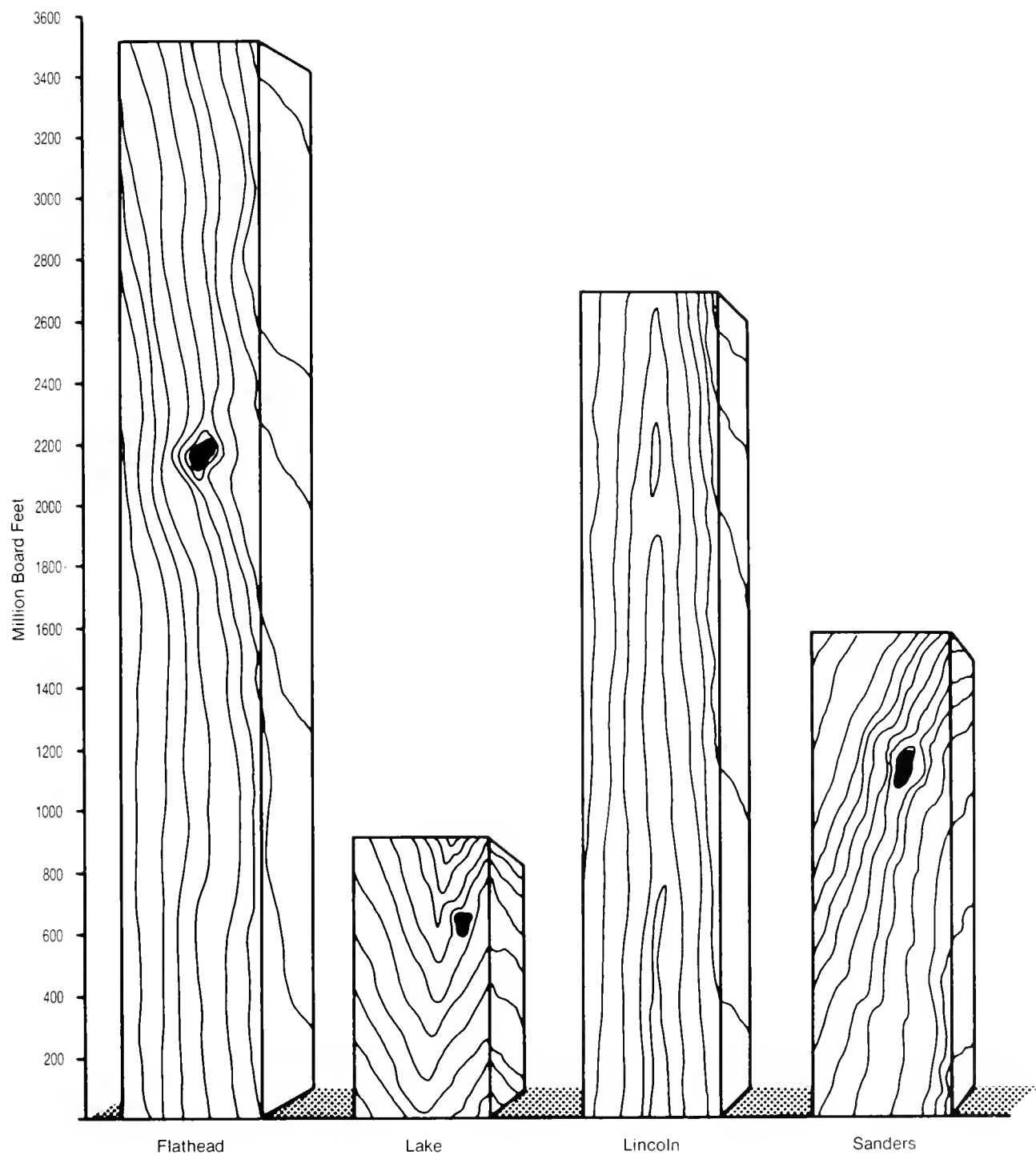


TABLE 69.
Net volume of growing stock on commercial timberland
by species and ownership group, Flathead County,
Working Circle 1 (thousand cubic feet).

Species	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	thousand cubic feet				
Douglas-fir	57,383	169,081	93,098	319,562	28.4
Lodgepole pine	58,893	120,964	68,819	248,677	22.1
Ponderosa pine	5,781	66,485	10,018	82,284	7.3
Western larch	56,365	125,756	45,077	227,199	20.2
Subalpine fir	31,664	9,732	4,625	46,021	4.1
Grand fir	8,235	39,230	8,689	56,154	5.0
Spruce	30,707	17,529	22,017	70,253	6.3
Western redcedar	2,315	11,583	3,739	17,637	1.6
Western hemlock*	196	6,378	3,014	9,588	0.9
Whitebark pine	8,293	14	24	8,331	0.7
Western white pine	5,989	9,647	1,392	17,028	1.5
Softwood species	265,820	576,401	260,513	1,102,733	98.1
Aspen	124	2,372	3,839	6,335	0.6
Cottonwood	1,090	995	4,362	6,447	0.6
Other hardwoods	2,113	346	5,276	7,735	0.7
Hardwood species	3,327	3,713	13,477	20,517	1.9
TOTAL	269,146	580,114	273,990	1,123,251	100.0

*Also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

TABLE 70.
Net volume of growing stock on commercial timberland
by species and ownership group, Lake County,
Working Circle 1 (thousand cubic feet).

Species	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	thousand cubic feet				
Douglas-fir	35,956	37,303	24,682	97,941	34.7
Lodgepole pine	14,499	18,323	12,588	45,410	16.1
Ponderosa pine	3,603	8,965	16,762	29,330	10.4
Western larch	28,664	7,888	12,232	48,784	17.3
Subalpine fir	2,837	2,566	845	6,248	2.2
Grand fir	5,081	5,596	818	11,496	4.1
Spruce	11,465	7,146	471	19,081	6.7
Western redcedar	4,634	224	1,682	6,539	2.3
Western hemlock*	112	266	632	1,010	0.4
Whitebark pine	525	4,345	26	4,896	1.7
Western white pine	2,360	885	656	3,901	1.4
Softwood species	109,734	93,508	71,395	274,637	97.3
Aspen	131	—	1,661	1,792	0.6
Cottonwood	374	351	1,968	2,693	1.0
Other hardwoods	2,286	80	874	3,240	1.1
Hardwood species	2,791	431	4,503	7,725	2.7
TOTAL	112,526	93,939	75,898	282,362	100.0

* Also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

TABLE 71.
Net volume of growing stock on commercial timberland
by species and ownership group, Lincoln County,
Working Circle 1 (thousand cubic feet).

Species	Ownership Group				Percentage of Total
	State and Other Public	Forest Industry	Other Private	Total	
	thousand cubic feet				
Douglas-fir	35,905	170,351	58,169	264,425	30.8
Lodgepole pine	28,976	117,737	39,081	185,794	21.7
Ponderosa pine	5,979	73,053	6,137	85,169	9.9
Western larch	23,428	122,234	27,310	172,972	20.2
Subalpine fir	6,490	8,907	2,618	18,014	2.1
Grand fir	5,797	34,325	5,470	45,592	5.3
Spruce	6,726	16,177	13,365	36,267	4.2
Western redcedar	574	10,135	2,394	13,103	1.5
Western hemlock*	179	6,107	2,079	8,365	1.0
Whitebark pine	1,620	13	6	1,639	0.2
Western white pine	1,304	7,803	789	9,895	1.2
Softwood species	116,978	566,841	157,417	841,236	98.1
Aspen	69	4,779	2,563	7,412	0.9
Cottonwood	906	935	2,627	4,468	0.5
Other hardwoods	1,158	277	3,154	4,589	0.5
Hardwood species	2,133	5,992	8,344	16,469	1.9
TOTAL	119,111	572,832	165,762	857,705	100.0

*Also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

TABLE 72.
Net volume of growing stock on commercial timberland
by species and ownership group, Sanders County,
Working Circle 1 (thousand cubic feet).

Species	Ownership Group				Percentage of Total
	State and Other Public	Forest Industry	Other Private	Total	
	thousand cubic feet				
Douglas-fir	44,396	114,053	51,277	209,727	39.8
Lodgepole pine	21,586	45,942	24,309	91,837	17.4
Ponderosa pine	14,439	26,441	35,453	76,332	14.5
Western larch	8,038	25,706	28,220	61,964	11.8
Subalpine fir	585	6,195	780	7,560	1.4
Grand fir	4,294	17,446	1,636	23,376	4.4
Spruce	1,299	23,013	726	25,038	4.8
Western redcedar	4	743	3,911	4,658	0.9
Western hemlock*	—	594	1,346	1,941	0.4
Whitebark pine	8	9,726	25	9,758	1.9
Western white pine	—	2,696	1,623	4,319	0.8
Softwood species	94,648	272,557	149,306	516,510	98.1
Aspen	—	—	4,109	4,109	0.8
Cottonwood	80	1,221	2,756	4,058	0.8
Other hardwoods	14	159	1,748	1,921	0.3
Hardwood species	94	1,380	8,614	10,087	1.9
TOTAL	94,742	273,936	157,920	526,598	100.0

*Also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

TABLE 73.
Net volume of sawtimber on commercial timberland
by species and ownership group, Flathead County,
Working Circle 1 (thousand board feet Scribner).

Species	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
			thousand board feet		
Douglas-fir	217,998	605,295	245,029	1,068,321	30.4
Lodgepole pine	119,963	141,527	107,180	368,670	10.5
Ponderosa pine	27,389	327,971	30,792	386,151	11.0
Western larch	259,962	559,215	133,633	952,811	27.1
Subalpine fir	76,777	19,068	4,759	100,604	2.9
Grand fir	26,063	137,306	24,528	187,896	5.3
Spruce	125,935	60,061	54,761	240,757	6.8
Western redcedar	7,231	37,953	10,473	55,658	1.6
Western hemlock*	368	17,748	7,876	25,991	0.7
Whitebark pine	36,825	33	56	36,914	1.0
Western white pine	26,382	39,240	3,286	68,907	2.0
Softwood species	924,892	1,945,416	622,373	3,492,681	99.3
Aspen	36	2,769	2,459	5,263	0.1
Cottonwood	3,467	986	14,682	19,135	0.5
Other hardwoods	1,709	33	56	1,798	0.1
Hardwood species	5,212	3,787	17,198	26,197	0.7
TOTAL	930,104	1,949,203	639,570	3,518,878	100.0

*Also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

TABLE 74.
Net volume of sawtimber on commercial timberland
by species and ownership group, Lake County,
Working Circle 1 (thousand board feet Scribner).

Species	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
			thousand board feet		
Douglas-fir	139,515	105,919	69,612	315,046	34.3
Lodgepole pine	23,808	25,280	26,265	75,353	8.2
Ponderosa pine	16,668	41,407	66,056	124,130	13.5
Western larch	128,827	32,156	35,303	196,286	21.3
Subalpine fir	7,551	5,815	2,355	15,721	1.7
Grand fir	17,802	14,932	2,546	35,281	3.8
Spruce	43,316	29,737	869	73,922	8.0
Western redcedar	15,966	582	4,273	20,821	2.3
Western hemlock*	194	399	1,163	1,756	0.2
Whitebark pine	2,141	20,398	61	22,600	2.5
Western white pine	10,772	4,568	2,239	17,578	1.9
Softwood species	406,559	281,194	210,742	898,495	97.7
Aspen	358	—	5,420	5,778	0.6
Cottonwood	1,232	1,482	8,269	10,984	1.2
Other hardwoods	3,966	8	481	4,455	0.5
Hardwood species	5,556	1,490	14,170	21,216	2.3
TOTAL	412,114	282,684	224,912	919,711	100.0

*Also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

TABLE 75.
Net volume of sawtimber on commercial timberland
by species and ownership, Lincoln County,
Working Circle 1 (thousand board feet Scribner).

Species	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	—thousand board feet—				
Douglas-fir	129,266	601,647	153,602	884,515	32.9
Lodgepole pine	46,503	129,644	62,716	238,863	8.9
Ponderosa pine	28,662	365,361	18,975	412,998	15.3
Western larch	100,268	540,053	81,077	721,398	26.8
Subalpine fir	14,687	16,582	2,676	33,946	1.3
Grand fir	18,622	119,035	15,588	153,245	5.7
Spruce	25,202	54,666	32,883	112,752	4.2
Western redcedar	1,829	32,994	6,979	41,803	1.5
Western hemlock*	308	16,557	5,435	22,300	0.8
Whitebark pine	7,326	29	15	7,370	0.3
Western white pine	5,577	31,872	1,940	39,389	1.5
Softwood species	378,250	1,908,442	381,886	2,668,578	99.2
Aspen	2	5,577	1,374	6,953	0.3
Cottonwood	2,732	1,389	8,545	12,666	0.5
Other hardwoods	1,201	29	15	1,246	**
Hardwood species	3,935	6,996	9,934	20,865	0.8
TOTAL	382,185	1,915,438	391,820	2,689,443	100.0

*Also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

**Less than 0.05%.

TABLE 76.
Net volume of sawtimber on commercial timberland
by species and ownership group, Sanders County,
Working Circle 1 (thousand board feet Scribner).

Species	Ownership Group			Total	Percentage of Total
	State and Other Public	Forest Industry	Other Private		
	—thousand board feet—				
Douglas-fir	135,452	326,649	143,559	605,659	38.2
Lodgepole pine	28,436	69,060	53,450	150,946	9.5
Ponderosa pine	54,266	121,975	139,261	315,501	19.9
Western larch	33,225	104,919	82,980	221,124	14.0
Subalpine fir	889	14,158	1,854	16,901	1.1
Grand fir	10,739	45,519	5,177	61,434	3.9
Spruce	2,583	95,643	1,201	99,427	6.3
Western redcedar	—	1,923	10,282	12,205	0.8
Western hemlock*	—	893	2,553	3,447	0.2
Whitebark pine	18	45,637	59	45,714	2.9
Western white pine	—	13,970	5,538	19,508	1.2
Softwood species	265,607	840,345	445,915	1,551,867	98.0
Aspen	—	—	13,408	13,408	0.8
Cottonwood	338	5,160	11,593	17,092	1.1
Other hardwoods	18	38	1,098	1,154	0.1
Hardwood species	356	5,198	26,099	31,653	2.0
TOTAL	265,963	845,543	472,014	1,583,520	100.0

*Also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

TABLE 77.
Net annual growth of growing stock on commercial
softwood forest types by county and ownership group,
Working Circle 1 (thousand cubic feet).

County	Ownership Group			
	State and Other Public	Forest Industry	Other Private	All Owners
	thousand cubic feet			
Flathead	5,135	12,198	8,144	25,477
Lake	2,308	1,677	2,443	6,428
Lincoln	2,835	12,624	5,166	20,625
Sanders	2,764	5,051	5,022	12,837
TOTAL	13,042	31,550	20,775	65,367

TABLE 78.
Net annual growth of sawtimber on commercial
softwood forest types by county and ownership group,
Working Circle 1 (thousand board feet Scribner).

County	Ownership Group			
	State and Other Public	Forest Industry	Other Private	All Owners
	thousand board feet			
Flathead	17,507	35,404	28,119	81,030
Lake	7,441	6,006	8,152	21,599
Lincoln	9,281	35,805	17,711	62,797
Sanders	6,585	16,321	16,921	39,827
TOTAL	40,814	93,536	70,903	205,253

TABLE 79.
Net annual mortality of growing stock on commercial
softwood forest types by county and ownership group,
Working Circle 1 (thousand cubic feet).

County	Ownership Group			
	State and Other Public	Forest Industry	Other Private	All Owners
	thousand cubic feet			
Flathead	1,276	2,965	1,389	5,630
Lake	517	464	280	1,261
Lincoln	463	2,613	810	3,886
Sanders	245	1,279	595	2,119
TOTAL	2,501	7,321	3,074	12,896

TABLE 80.

Net annual mortality of sawtimber on commercial softwood forest types by county and ownership group, Working Circle 1 (thousand board feet Scribner).

County	Ownership Group			
	State and Other Public	Forest Industry	Other Private	All Owners
	thousand board feet			
Flathead	3,942	8,430	2,845	15,217
Lake	1,946	1,035	570	3,551
Lincoln	1,229	7,114	1,691	10,034
Sanders	965	3,252	1,257	5,474
TOTAL	8,082	19,831	6,363	34,276

TABLE 81.

Net annual growth of growing stock and sawtimber per acre on commercial timberland by county, Working Circle 1 (cubic feet per acre, board feet Scribner per acre).

County	Growing Stock cubic feet/acre	Sawtimber board feet/acre
Flathead	44.0	139.9
Lake	38.1	128.0
Lincoln	42.9	130.5
Sanders	38.7	120.0

TABLE 82.

Net annual mortality of growing stock and sawtimber per acre on commercial timberland by county, Working Circle 1 (cubic feet per acre, board feet Scribner per acre).

County	Growing Stock cubic feet/acre	Sawtimber board feet/acre
Flathead	9.7	26.3
Lake	7.5	21.0
Lincoln	8.1	20.8
Sanders	6.4	16.5

TABLE 83.
Area of commercial timberland by MAI site class
for softwood and hardwood forest types by county,
Working Circle 1 (thousand acres).

MAI Site Class	Softwood Forest Types	Hardwood Forest Types	Total
	<hr/> thousand acres <hr/>		
Flathead County			
20 - 49	69.4	1.6	71.0
50 - 84	284.4	2.8	287.2
85 - 119	166.6	0.4	167.0
120 - 164	53.5	1.9	55.4
165+	5.2	—	5.2
TOTAL	579.1	6.7	585.8
Lake County			
20 - 49	20.3	2.3	22.6
50 - 84	77.3	—	77.3
85 - 119	60.6	0.3	60.9
120 - 164	8.5	1.3	9.8
165+	2.1	—	2.1
TOTAL	168.8	3.9	172.7
Lincoln County			
20 - 49	63.7	0.6	64.3
50 - 84	245.5	1.4	246.9
85 - 119	128.9	0.2	129.1
120 - 164	39.9	1.8	41.7
165+	3.3	—	3.3
TOTAL	481.3	4.0	485.3
Sanders County			
20 - 49	47.0	2.0	49.0
50 - 84	165.0	—	165.0
85 - 119	100.9	0.3	101.2
120 - 164	14.4	3.0	17.4
165+	4.4	—	4.4
TOTAL	331.7	5.3	337.0
Working Circle Totals			
20 - 49	200.4	6.5	206.9
50 - 84	772.2	4.2	776.4
85 - 119	457.0	1.2	458.2
120 - 164	116.3	8.0	124.3
165+	15.0	—	15.0
TOTAL	1,560.9	19.9	1,580.8

TABLE 84.
Area of commercial timberland by habitat type and
county, Working Circle 1 (thousand acres).

Habitat Type	County				Total
	Flathead	Lake	Lincoln	Sanders	
PIPO/FEID	5.2	1.3	3.3	3.0	12.7
PIPO/SYAL	1.9	—	1.8	0.5	4.2
PSME/AGSP	0.9	0.6	0.8	1.8	4.1
PSME/FEID	2.5	—	1.8	—	4.3
PSME/FESC	4.2	4.0	3.7	7.2	19.1
PSME/VACA	58.2	5.8	59.0	13.9	136.9
PSME/PHMA	16.5	9.4	13.3	26.1	65.3
PSME/VAGL	11.6	—	11.3	1.9	24.7
PSME/LIBO	36.1	2.2	36.3	1.7	76.3
PSME/SYAL	53.7	12.2	44.6	29.3	139.8
PSME/CARU	59.9	25.9	62.0	73.3	221.1
PSME/CAGE	2.4	1.4	3.8	8.5	16.1
PSME/SPBE	5.0	3.5	3.9	5.9	18.4
PSME/ARUV	6.5	2.6	6.4	6.0	21.6
PICEA/EQAR	7.1	1.0	5.8	3.4	17.3
PICEA/CLUN	25.4	1.5	16.8	3.5	47.3
PICEA/GATR	4.0	2.3	2.5	3.8	12.6
PICEA/VACA	10.4	0.5	8.5	0.4	19.7
PICEA/LIBO	7.9	0.5	7.4	—	15.8
ABGR/XETE	2.1	1.3	2.2	3.0	8.7
ABGR/CLUN	47.5	23.4	33.8	37.9	142.6
ABGR/LIBO	21.2	16.4	21.5	48.4	107.6
THPL/CLUN	38.1	24.2	24.1	19.6	105.9
TSHE/CLUN	63.3	8.2	56.6	17.2	145.3
ABLA/CLUN	40.8	16.3	27.6	9.1	94.0
ABLA/GATR	1.9	—	1.8	—	3.7
ABLA/VACA	9.2	0.7	5.7	0.4	15.9
ABLA/LIBO	0.3	*	0.4	—	0.7
ABLA/MEFE	13.7	2.7	3.6	0.4	20.3
ABLA/XETE	16.6	1.8	10.8	5.2	34.4
ABLA/CAGE	2.6	0.3	2.4	1.8	7.0
ABLA/LUHI	8.7	1.1	1.8	0.4	11.9
TSME/LUHI	—	1.3	—	3.0	4.3
PIAL/ABLA	0.4	0.3	0.2	0.4	1.3
TOTAL	585.8	172.7	485.3	337.0	1,580.8

*Less than 50 acres.

TABLE 85.
Area of commercial timberland by condition class,
crown density, and county, Working Circle 1 (thousand acres).

Condition Class	Crown Density (%)				Total
	0-30	31-50	51-70	71+*	
	thousand acres				
Flathead County					
Excellent	31.7	98.9	71.0	—	201.6
Good	35.2	59.8	56.2	—	151.2
Fair	30.6	12.6	16.9	—	60.1
Poor	12.0	5.3	3.0	—	20.3
				152.6	152.6
TOTAL	109.5	176.6	147.1	152.6	585.8
Lake County					
Excellent	17.0	32.3	21.7	—	71.0
Good	30.6	10.8	7.9	—	49.3
Fair	7.3	0.8	3.1	—	11.2
Poor	0.8	0.3	0.2	—	1.3
				39.9	39.9
TOTAL	55.7	44.2	32.9	39.9	172.7
Lincoln County					
Excellent	34.1	93.1	54.5	—	181.7
Good	37.9	44.5	32.0	—	114.4
Fair	36.9	7.1	9.6	—	53.6
Poor	10.7	3.3	2.5	—	16.5
				119.1	119.1
TOTAL	119.6	148.0	98.6	119.1	485.3
Sanders County					
Excellent	32.7	69.4	39.5	—	141.6
Good	60.5	20.8	16.0	—	97.3
Fair	15.9	0.7	2.8	—	19.4
Poor	—	0.4	—	—	0.4
				78.3	78.3
TOTAL	109.1	91.3	58.3	78.3	337.0
Working Circle Total					
Excellent	115.5	293.7	186.7	—	595.9
Good	164.2	135.9	112.1	—	412.2
Fair	90.7	21.2	32.4	—	144.3
Poor	23.5	9.3	5.7	—	38.5
				389.9	389.9
TOTAL	393.9	460.1	336.9	389.9	1,580.8

*No range data were collected on forest land with greater than 70% crown density because the range is considered to have no value for livestock.

TABLE 86.
Available animal unit months (AUMs) on commercial
timberland by condition class, crown density, and county,
Working Circle 1.

Condition Class	Crown Density (%)				Total
	0-30	31-50	51-70	71+	
	AUMs				
Flathead County					
Excellent	10,385	18,545	6,928	—	35,858
Good	8,008	7,027	3,532	—	18,567
Fair	6,307	1,627	511	—	8,445
Poor	1,488	509	31	—	2,028
TOTAL	26,188	27,708	11,002	—	64,898
Lake County					
Excellent	4,673	6,254	1,442	—	12,369
Good	6,333	1,105	583	—	8,021
Fair	1,050	48	242	—	1,340
Poor	6	13	10	—	29
TOTAL	12,062	7,420	2,277	—	21,759
Lincoln County					
Excellent	11,052	17,833	5,466	—	34,351
Good	9,743	5,520	1,962	—	17,225
Fair	8,333	1,228	292	—	9,853
Poor	1,215	318	31	—	1,564
TOTAL	30,343	24,899	7,751	—	62,993
Sanders County					
Excellent	8,624	12,370	2,356	—	23,350
Good	13,468	2,296	1,076	—	16,840
Fair	2,753	11	415	—	3,179
Poor	—	18	—	—	18
TOTAL	24,845	14,695	3,847	—	43,387
Working Circle Total					
Excellent	34,734	55,002	16,192	—	105,928
Good	37,552	15,948	7,153	—	60,653
Fair	18,443	2,914	1,460	—	22,817
Poor	2,709	858	72	—	3,639
TOTAL	93,438	74,722	24,877	—	193,037

TABLE 87.
Potential available animal unit months (AUMs) on
commercial timberland by crown density and county,
Working Circle 1.

County	Crown Density (%)				Total
	0-30	31-50	51-70	71+*	
	AUMs				
Flathead	39,655	35,985	11,731	—	87,371
Lake	15,943	8,290	2,521	—	26,754
Lincoln	44,818	31,260	8,205	—	84,283
Sanders	33,202	16,357	4,512	—	54,071
TOTAL	133,618	91,892	26,969	—	252,479

*No range data were collected on forest land with greater than 70% crown density because the range is considered to have no value for livestock.

units per month, an increase of 35 percent. Lake County is the closest to reaching its potential carrying capacity. Improving all the grazable forest land in Lake County to excellent condition would have provided about 5,000 more AUMs, or 23 percent more than was available.

Table 88 shows the number of AUMs that were available per acre in each county at the time of sampling. Lincoln and Sanders counties, which had a slight edge in this category, also had the highest potential AUMs per acre (see table 89).

TIMBERLAND QUALITY CLASS BY COUNTY

In each county in Working Circle 1, more sampled timberlands were in the good timberland quality class than in any other. Excellent quality timberlands were the second most common (see table 90). Over three-fourths of the sampled commercial timberlands in Lincoln and Flathead counties were in these highest quality classes. Overall, timberland quality in Lake and Sanders counties was not quite as high. Nevertheless, over two-thirds of the timberlands in these counties were in the excellent or good classes.

SILVICULTURAL TREATMENT OPPORTUNITIES

Flathead County

In Flathead County, the two leading silvicultural treatment opportunity categories were harvest-low risk--150,800 acres and harvest-high risk--99,900 acres (see tables 91 and 92). Some of the other leading categories were: regeneration of understocked areas--35,100 acres; precommercial thinning--28,300 acres; no treatment due to productive condition--26,900 acres; and sanitation--26,300 acres.

About 49 percent of Flathead County's commercial softwood timberlands offered some type of treatment opportunity other than harvest. If the harvest-high risk category is included, treatment opportunities were available on 381,700 acres, or 66 percent of the commercial timberlands in the county.

Of those timberlands rated as excellent or good for producing timber, 159,100 acres (36 percent) offered no immediate treatment opportunities (codes 11, 30, 32, 33, and 40). Therefore, 287,200 acres of those timberlands rated as excellent and good can be treated to improve the

TABLE 88.
Available animal units months (AUMs) per acre on
commercial timberland by condition class, crown density, and
county, Working Circle 1.

Condition Class	Crown Density (%)				Total
	0-30	31-50	51-70	71+*	
	AUMs				
Flathead County					
Excellent	0.33	0.19	0.10	—	0.18
Good	0.23	0.12	0.06	—	0.12
Fair	0.21	0.13	0.03	—	0.14
Poor	0.12	0.10	0.01	—	0.10
TOTAL	0.24	0.16	0.07	—	0.15
Lake County					
Excellent	0.27	0.19	0.07	—	0.17
Good	0.21	0.10	0.07	—	0.16
Fair	0.14	0.06	0.08	—	0.12
Poor	0.01	0.04	0.05	—	0.02
TOTAL	0.22	0.17	0.07	—	0.16
Lincoln County					
Excellent	0.32	0.19	0.10	—	0.19
Good	0.26	0.12	0.06	—	0.15
Fair	0.23	0.17	0.03	—	0.18
Poor	0.11	0.10	0.01	—	0.10
TOTAL	0.25	0.17	0.08	—	0.17
Sanders County					
Excellent	0.26	0.18	0.06	—	0.16
Good	0.22	0.11	0.07	—	0.17
Fair	0.17	0.02	0.15	—	0.16
Poor	—	0.04	—	—	0.04
TOTAL	0.23	0.16	0.07	—	0.17
Working Circle Total					
Excellent	0.30	0.19	0.09	—	0.18
Good	0.23	0.12	0.06	—	0.15
Fair	0.20	0.14	0.05	—	0.16
Poor	0.12	0.09	0.01	—	0.09
TOTAL	0.24	0.16	0.07	—	0.16

*No range data were collected on forest land with greater than 70% crown density because the range is considered to have no value for livestock.

TABLE 89.
Potential available animal unit months (AUMs) per
acre on commercial timberland by crown density and county,
Working Circle 1.

County	0-30	Crown Density (%)			Total
		31-50	51-70	71+*	
		AUMs			
Flathead	0.36	0.20	0.08	—	0.20
Lake	0.29	0.19	0.08	—	0.20
Lincoln	0.37	0.21	0.08	—	0.23
Sanders	0.30	0.18	0.08	—	0.21
TOTAL	0.34	0.20	0.08	—	0.21

*No range data were collected on forest land with greater than 70% crown density because the range is considered to have no value for livestock.

TABLE 90.
Area of commercial softwood timberland by timberland
quality class and county, Working Circle 1 (thousand acres).

Timberland Quality Class	County									
	Flathead		Lake		Lincoln		Sanders		Total	
	thousand acres		thousand acres		thousand acres		thousand acres		thousand acres	
		%		%		%		%		%
Excellent	196.3	33.9	55.1	32.6	154.2	32.1	89.8	27.1	495.5	31.7
Good	250.0	43.2	61.9	36.7	222.0	46.1	135.4	40.8	669.2	42.9
Fair	112.0	19.3	33.2	19.7	96.9	20.1	84.2	25.4	326.3	20.9
Poor	20.8	3.6	18.6	11.0	8.1	1.7	22.4	6.7	69.8	4.5
TOTAL	579.1	100.0	168.8	100.0	481.3	100.0	331.7	100.0	1,560.9	100.0

TABLE 91.
Treatment opportunity code definitions for tables 92 through 102.

10	Harvest - high risk
11	Harvest - low risk
12	Commercial thinning
13	Overstory removal
20	Precommercial thinning
21	Stand conversion
22	Sanitation
23	Regeneration of understocked areas
30	No treatment due to productive condition
32	No treatment-inoperable
33	No treatment-deferred until merchantable
40	Unknown - poor crowns, good growth

No Overlap

12, 13	Commercial thinning, overstory removal
13, 20	Overstory removal, precommercial thinning
13, 20, 23	Overstory removal, precommercial thinning, regeneration of understocked areas
13, 21	Overstory removal, stand conversion
13, 23	Overstory removal, regeneration of understocked areas
13, 33	Overstory removal, no treatment-deferred until merchantable
20, 23	Precommercial thinning, regeneration of understocked areas
22, 23	Sanitation, regeneration of understocked areas
22, 33	Sanitation, no treatment-deferred until merchantable

Possible Overlap

12, 13, 22	Commercial thinning, overstory removal, sanitation
12, 22	Commercial thinning, sanitation
13, 20, 22	Overstory removal, precommercial thinning, sanitation
13,20,22,23	Overstory removal, precommercial thinning, sanitation, regeneration of understocked areas
13, 22	Overstory removal, sanitation
13, 22, 23	Overstory removal, sanitation, regeneration of understocked areas
13, 22, 33	Overstory removal, sanitation, no treatment-deferred until merchantable
20, 22	Precommercial thinning, sanitation
20, 22, 23	Precommercial thinning, sanitation, regeneration of understocked areas

TABLE 92.
Area of commercial softwood timberland by treatment
opportunity group and site class, Flathead County,
Working Circle 1 (thousand acres).

Treatment Opportunity	Site Class (cubic feet/acre/year)					Total
	20-49	50-84	85-119	120-164	165+	
10	10.8	45.3	31.3	12.5	—	99.9
11	8.5	79.0	54.5	6.4	2.4	150.8
12	—	—	—	—	—	—
13	—	8.4	5.0	—	2.8	16.2
20	7.3	10.2	8.0	2.9	—	28.3
21	6.7	13.2	2.7	2.8	—	25.5
22	2.5	14.6	6.5	2.7	—	26.3
23	9.1	18.6	6.9	0.6	—	35.1
30	3.6	7.2	12.6	3.5	—	26.9
32	1.2	0.5	0.3	—	—	2.0
33	0.4	5.2	—	2.5	—	8.1
40	—	6.8	2.8	—	—	9.6
12, 13	—	—	—	—	—	—
13, 20	2.1	18.6	1.5	—	—	22.3
13, 20, 23	1.2	—	—	—	—	1.2
13, 21	—	5.1	—	2.2	—	7.3
13, 23	2.9	3.8	1.5	—	—	8.1
13, 33	—	2.0	—	—	—	2.0
20, 23	2.8	10.7	1.2	—	—	14.7
22, 23	—	2.0	3.4	—	—	5.4
22, 33	2.4	—	—	—	—	2.4
12, 13, 22	—	2.7	2.4	—	—	5.1
12, 22	—	—	2.4	4.5	—	6.9
13, 20, 22	—	11.5	4.8	3.5	—	19.8
13, 20, 22, 23	—	—	—	—	—	—
13, 22	2.1	8.0	5.9	—	—	16.0
13, 22, 23	2.1	4.0	2.1	—	—	8.3
13, 22, 33	—	—	—	2.4	—	2.4
20, 22	3.5	5.5	8.4	0.6	—	18.0
20, 22, 23	—	1.5	2.5	6.4	—	10.4
TOTAL	69.4	284.4	166.6	53.5	5.2	579.1

forest's overall condition and timber production (see table 93).

Forest acreage by treatment class figures show the total number of acres offering opportunities for particular treatments. These figures also make it

easier to identify the most common treatment categories without adding up the acreages for the different combination codes. The four most common treatment classes in Flathead County were: harvest-low risk--150,800 acres; sanitation--

TABLE 93.
Area of commercial softwood timberland by treatment
opportunity group and timberland quality class, Flathead County,
Working Circle 1 (thousand acres).

Treatment Opportunity	Timberland Quality Class				Total
	Excellent	Good	Fair	Poor	
	thousand acres				
10	36.5	42.3	16.9	4.3	99.9
11	54.4	66.9	21.9	7.5	150.8
12	—	—	—	—	—
13	7.8	8.4	—	—	16.2
20	10.9	9.8	7.3	0.4	28.3
21	5.5	10.1	8.9	1.0	25.5
22	6.4	13.1	5.3	1.5	26.3
23	4.6	18.1	11.5	0.9	35.1
30	15.5	5.0	6.3	—	26.9
32	—	—	—	2.0	2.0
33	2.5	5.2	—	0.4	8.1
40	2.8	6.8	—	—	9.6
12, 13	—	—	—	—	—
13, 20	0.3	17.6	3.1	1.2	22.3
13, 20, 23	—	—	1.2	—	1.2
13, 21	2.1	5.1	—	—	7.3
13, 23	1.5	3.5	2.9	0.3	8.1
13, 33	—	2.0	—	—	2.0
20, 23	1.2	4.3	8.0	1.2	14.7
22, 23	3.4	1.6	0.4	—	5.4
22, 33	—	—	2.4	—	2.4
12, 13, 22	2.4	2.7	—	—	5.1
12, 22	6.9	—	—	—	6.9
13, 20, 22	8.3	11.5	—	—	19.8
13, 20, 22, 23	—	—	—	—	—
13, 22	3.5	5.5	7.0	—	16.0
13, 22, 23	—	4.1	4.3	—	8.3
13, 22, 33	2.4	—	—	—	2.4
20, 22	8.6	4.9	4.4	—	18.0
20, 22, 23	8.9	1.5	—	—	10.4
TOTAL	196.3	250.0	112.0	20.8	579.1

120,900 acres; precommercial thinning--
114,700 acres; and overstory removal--
108,800 acres (see table 94).

Lake County

In Lake County, the two leading silvi-
cultural treatment opportunity categories
were harvest-high risk--35,100 acres--and

harvest-low risk--25,700 acres (see table
95). Some of the other leading categories
were: regeneration of understocked areas
--19,400 acres; sanitation--13,800 acres;
precommercial thinning--13,600 acres; and
no treatment due to productive condition
--10,400 acres.

About 54 percent of the county's com-
mercial softwood timberlands offered some
type of treatment opportunity other than

TABLE 94.
Area of commercial softwood timberland by
treatment class and timberland quality class,
Flathead County, Working Circle 1 (thousand acres).

Stand Treatment Class	Timberland Quality Class				Total
	Excellent	Good	Fair	Poor	
	—thousand acres—				
Harvest-high risk	36.5	42.3	16.9	4.3	99.9
Harvest-low risk	54.4	66.9	21.9	7.5	150.8
Commercial thinning	9.3	2.7	—	—	12.0
Overstory removal	28.3	60.4	18.6	1.5	108.8
Precommercial thinning	38.2	49.5	24.1	2.9	114.7
Stand conversion	7.6	15.2	8.9	1.0	32.7
Sanitation	50.8	44.9	23.8	1.5	120.9
Regeneration of understocked areas	19.6	33.0	28.4	2.4	83.4
No treatment due to productive condition	15.5	5.0	6.3	—	26.9
No treatment-inoperable	—	—	—	2.0	2.0
No treatment-deferred until merchantable	4.8	7.2	2.4	0.4	14.9
Unknown-poor crowns, good growth	2.8	6.8	—	—	9.6
TOTAL	267.8	333.9	151.3	23.5	776.6

TABLE 95.
Area of commercial softwood timberland by treatment
opportunity group and site class, Lake County,
Working Circle 1 (thousand acres).

Treatment Opportunity	Site Class (cubic feet/acre/year)					Total
	20-49	50-84	85-119	120-164	165+	
	thousand acres					
10	3.7	16.3	13.6	1.5	—	35.1
11	2.5	12.0	8.1	1.7	1.3	25.7
12	—	—	1.6	—	—	1.6
13	—	0.5	0.3	—	—	0.8
20	3.3	2.6	6.9	—	0.8	13.6
21	1.3	3.7	1.3	—	—	6.3
22	2.2	6.0	4.1	1.5	—	13.8
23	2.4	10.1	5.1	1.8	—	19.4
30	—	4.7	4.2	1.5	—	10.4
32	—	3.2	*	—	—	3.2
33	0.3	—	—	—	—	0.3
40	—	1.6	1.6	—	—	3.3
12, 13	—	—	—	—	—	—
13, 20	—	1.6	*	—	—	1.7
13, 20, 23	—	0.6	—	—	—	0.6
13, 21	—	0.2	—	—	—	0.2
13, 23	—	0.1	1.0	—	—	1.1
13, 33	1.3	0.8	—	—	—	2.1
20, 23	—	1.5	0.6	—	—	2.1
22, 23	1.0	2.6	—	—	—	3.6
22, 33	—	1.6	—	—	—	1.6
12, 13, 22	—	0.2	—	—	—	0.2
12, 22	—	—	1.0	—	—	1.0
13, 20, 22	—	2.9	0.9	—	—	3.8
13, 20, 22, 23	—	—	—	—	—	—
13, 22	1.3	0.3	2.7	—	—	4.4
13, 22, 23	—	*	1.3	—	—	1.3
13, 22, 33	—	—	—	—	—	—
20, 22	1.0	3.5	5.4	0.2	—	10.2
20, 22, 23	—	1.0	0.5	—	—	1.5
TOTAL	20.3	77.8	60.4	8.2	2.1	168.8

* Less than 50 acres.

harvest. If harvest-high risk is included, this percentage expands to 75 percent, or 125,900 acres.

Of those lands rated as excellent or good for producing timber, 28,600 acres

(24 percent) offered no immediate treatment opportunities (codes 11, 30, 32, 33, and 40). Thus, 88,400 acres of excellent and good quality timberlands can be treated (see table 96).

TABLE 96.
Area of commercial softwood timberland by treatment
opportunity group and timberland quality class,
Lake County, Working Circle 1 (thousand acres).

Treatment Opportunity	Timberland Quality Class				
	Excellent	Good	Fair	Poor	Total
thousand acres					
10	11.8	14.6	7.1	1.5	35.1
11	9.5	8.1	5.2	2.8	25.7
12	1.6	—	—	—	1.6
13	0.3	0.5	—	—	0.8
20	4.8	2.3	4.1	2.3	13.5
21	1.3	1.5	3.5	—	6.3
22	3.5	5.8	3.4	1.1	13.8
23	6.6	9.0	2.4	1.4	19.4
30	4.9	2.9	1.2	1.3	10.4
32	—	—	—	3.2	3.2
33	—	—	—	0.3	0.3
40	1.6	1.6	—	—	3.3
12, 13	—	—	—	—	—
13, 20	—	1.6	—	—	1.7
13, 20, 23	—	0.6	—	—	0.6
13, 21	—	0.2	—	—	0.2
13, 23	1.0	—	—	—	1.0
13, 33	—	0.8	1.3	—	2.1
20, 23	0.6	1.5	—	—	2.1
22, 23	—	2.3	0.3	1.0	3.6
22, 33	—	1.6	—	—	1.6
12, 13, 22	—	0.2	—	—	0.2
12, 22	1.0	—	—	—	1.0
13, 20, 22	0.9	2.9	—	—	3.8
13, 20, 22, 23	—	—	—	—	—
13, 22	0.5	0.3	2.1	1.5	4.4
13, 22, 23	1.3	—	—	—	1.3
13, 22, 33	—	—	—	—	—
20, 22	3.7	3.2	1.6	1.6	10.2
20, 22, 23	—	—	1.0	0.5	1.5
TOTAL	55.1	61.9	33.2	18.6	168.8

Forest acreage by treatment class figures show the total number of acres offering particular treatment opportunities. The four most common treatment classes in Lake County were: sanitation--41,400 acres; harvest-high risk--35,100 acres; precommercial thinning--33,400 acres; and regeneration of understocked areas--29,600 acres (see table 97).

Lincoln County

The two leading treatment opportunity categories in Lincoln County were harvest-low risk--115,900 acres--and harvest-high risk--84,300 acres (see table 98). Some of the other leading categories were: regeneration of understocked areas--36,400 acres; precommercial thinning--

30,700 acres; no treatment due to productive condition--21,700 acres; and sanitation--17,800 acres.

About 51 percent of the commercial softwood timberlands in Lincoln County offered treatment opportunities other than harvest. If the harvest-high risk category is included, this figure jumps to 69 percent, or 330,300 acres.

Of those lands in Lincoln County rated as excellent or good for timber production, 123,100 acres (33 percent) offered no immediate treatment opportunities (codes 11, 30, 32, 33, and 40). In other words, 253,100 acres of the best quality timberlands offered silvicultural treatment opportunities (see table 99).

Forest acreage by treatment class figures indicate that the four most common

TABLE 97.
Area of commercial softwood timberland by
treatment class and timberland quality class,
Lake County, Working Circle 1 (thousand acres).

Stand Treatment Class	Timberland Quality Class				Total
	Excellent	Good	Fair	Poor	
	thousand acres				
Harvest-high risk	11.8	14.6	7.1	1.5	35.1
Harvest-low risk	9.5	8.1	5.2	2.8	25.7
Commercial thinning	2.7	0.2	—	—	2.9
Overstory removal	4.0	7.2	3.4	1.5	16.2
Precommercial thinning	10.0	12.2	6.7	4.5	33.4
Stand conversion	1.3	1.7	3.5	—	6.5
Sanitation	10.9	16.4	8.4	5.7	41.4
Regeneration of understocked areas	9.6	13.5	3.6	2.9	29.6
No treatment due to productive condition	4.9	2.9	1.2	1.3	10.4
No treatment-inoperable	—	—	—	3.2	3.2
No treatment-deferred until merchantable	—	2.5	1.3	0.3	4.0
Unknown-poor crowns, good growth	1.6	1.6	—	—	3.3
TOTAL	66.3	80.9	40.4	23.7	211.7

TABLE 98.
Area of commercial softwood timberland by treatment
opportunity group and site class, Lincoln County,
Working Circle 1 (thousand acres).

Treatment Opportunity	Site Class (cubic feet/acre/year)					Total
	20-49	50-84	85-119	120-164	165+	
10	8.9	42.3	25.1	8.0	—	84.3
11	4.8	63.9	41.1	4.2	1.9	115.9
12	—	—	—	—	—	—
13	—	6.5	4.2	—	1.4	12.0
20	6.6	15.9	5.3	3.0	—	30.7
21	4.7	8.0	2.7	1.4	—	16.8
22	1.5	9.0	4.9	2.3	—	17.8
23	14.3	14.5	7.1	0.6	—	36.4
30	5.0	5.9	8.5	2.4	—	21.7
32	0.2	0.6	0.4	—	—	1.1
33	0.2	3.3	—	1.5	—	5.0
40	—	5.9	1.4	—	—	7.3
12, 13	—	—	—	—	—	—
13, 20	1.7	14.7	0.6	—	—	17.0
13, 20, 23	0.2	—	—	—	—	0.2
13, 21	—	4.7	—	2.2	—	6.9
13, 23	5.6	6.2	2.8	—	—	14.6
13, 33	—	3.0	—	—	—	3.0
20, 23	2.9	7.9	0.2	—	—	11.0
22, 23	—	0.8	2.2	—	—	3.0
22, 33	1.9	—	—	—	—	1.9
12, 13, 22	—	2.8	1.9	—	—	4.7
12, 22	—	—	1.9	4.1	—	6.0
13, 20, 22	—	11.0	4.7	1.9	—	17.6
13, 20, 22, 23	—	—	—	—	—	—
13, 22	2.2	5.7	5.0	—	—	12.8
13, 22, 23	2.2	3.9	2.2	—	—	8.3
13, 22, 33	—	—	—	1.9	—	1.9
20, 22	2.1	5.2	4.9	0.6	—	12.8
20, 22, 23	—	2.9	1.8	5.9	—	10.6
TOTAL	64.9	244.5	128.7	39.9	3.3	481.3

TABLE 99.
Area of commercial softwood timberland by treatment
opportunity group and timberland quality class,
Lincoln County, Working Circle 1 (thousand acres).

Treatment Opportunity	Timberland Quality Class				Total
	Excellent	Good	Fair	Poor	
	thousand acres				
10	29.2	41.3	12.7	1.2	84.3
11	42.6	54.5	15.8	3.0	115.9
12	—	—	—	—	—
13	5.6	6.5	—	—	12.0
20	8.2	15.7	6.6	0.2	30.7
21	4.2	5.5	6.8	0.3	16.8
22	5.1	8.5	3.6	0.5	17.8
23	6.1	14.9	14.6	0.8	36.4
30	10.2	3.7	7.8	—	21.7
32	—	—	—	1.1	1.1
33	1.5	3.3	—	0.2	5.0
40	1.4	5.9	—	—	7.3
12, 13	—	—	—	—	—
13, 20	0.4	14.4	2.0	0.2	17.0
13, 20, 23	—	—	0.2	—	0.2
13, 21	2.2	4.7	—	—	6.9
13, 23	2.8	5.8	5.6	0.4	14.6
13, 33	—	3.0	—	—	3.0
20, 23	0.2	4.4	6.2	0.2	11.0
22, 23	2.2	0.6	0.2	—	3.0
22, 33	—	—	1.9	—	1.9
12, 13, 22	1.9	2.8	—	—	4.7
12, 22	6.0	—	—	—	6.0
13, 20, 22	6.6	11.0	—	—	17.6
13, 20, 22, 23	—	—	—	—	—
13, 22	3.1	4.2	5.6	—	12.8
13, 22, 23	—	3.9	4.4	—	8.3
13, 22, 33	1.9	—	—	—	1.9
20, 22	5.3	4.6	2.9	—	12.8
20, 22, 23	7.6	2.9	—	—	10.6
TOTAL	154.2	222.0	96.9	8.1	481.3

treatment classes in Lincoln County were: harvest-low risk--115,900 acres; precommercial thinning--99,800 acres; overstory removal--98,900 acres; and sanitation--97,300 acres (see table 100).

Sanders County

The two leading treatment opportunity categories in Sanders County were harvest-high risk--57,200 acres--and harvest-low risk--50,300 acres (see table 101). Some of the other leading treatment categories were: regeneration of understocked areas--39,900 acres; sanitation--34,500 acres; precommercial thinning--22,900 acres; and no treatment due to productive condition--21,900 acres.

About 58 percent of the commercial softwood timberlands in this county of-

fered treatment opportunities other than harvest. If harvest-high risk is included, this amount increases to 75 percent (249,200 acres).

Of those timberlands in the county rated as excellent or good for producing timber, 58,000 acres (26 percent) offered no immediate treatment opportunities (codes 11, 30, 32, 33, and 40). Therefore, 167,200 acres of these timberlands offered silvicultural treatment opportunities (see table 102).

Forest acreage by treatment class data (see table 103) indicate that the four most common treatment classes in Sanders County were: sanitation--88,100 acres; regeneration of understocked areas--62,600 acres; precommercial thinning--62,200 acres; and harvest-high risk--57,200 acres.

TABLE 100.
Area of commercial softwood timberland by
treatment class and timberland quality class,
Lincoln County, Working Circle 1 (thousand acres).

Stand Treatment Class	Timberland Quality Class				
	Excellent	Good	Fair	Poor	Total
	thousand acres				
Harvest-high risk	29.2	41.3	12.7	1.2	84.3
Harvest-low risk	42.6	54.4	15.8	3.0	115.9
Commercial thinning	7.8	2.8	—	—	10.6
Overstory removal	24.4	56.2	17.7	0.6	98.9
Precommercial thinning	28.3	53.0	17.9	0.6	99.8
Stand conversion	6.3	10.2	6.8	0.3	23.7
Sanitation	39.7	38.5	18.6	0.5	97.3
Regeneration of understocked areas	18.9	32.6	31.2	1.4	84.1
No treatment due to productive condition	10.2	3.7	7.8	—	21.7
No treatment-inoperable	—	—	—	1.1	1.1
No treatment-deferred until merchantable	3.4	6.3	1.9	0.2	11.8
Unknown-poor crowns, good growth	1.4	5.9	—	—	7.3
TOTAL	212.2	304.9	130.4	8.9	656.5

TABLE 101.
Area of commercial softwood timberland by treatment
opportunity group and site class, Sanders County,
Working Circle 1 (thousand acres).

Treatment Opportunity	Site Class (cubic feet/acre/year)					Total
	20-49	50-84	85-119	120-164	165+	
	thousand acres					
10	6.5	30.8	16.3	3.5	—	57.2
11	3.9	26.0	15.6	1.8	3.0	50.3
12	—	—	4.2	—	—	4.2
13	—	3.3	—	—	—	3.3
20	6.7	6.7	9.5	—	—	22.9
21	2.7	9.6	3.4	—	1.4	17.1
22	6.5	18.5	6.5	3.0	—	34.5
23	7.1	18.9	11.1	3.0	—	39.9
30	—	9.3	9.2	3.3	—	21.9
32	—	—	—	—	—	—
33	0.4	1.4	—	—	—	1.8
40	—	4.2	4.2	—	—	8.5
12, 13	—	—	—	—	—	—
13, 20	—	3.9	—	—	—	3.9
13, 20, 23	—	—	—	—	—	—
13, 21	—	—	—	—	—	—
13, 23	—	—	4.8	—	—	4.8
13, 33	3.0	1.9	—	—	—	4.8
20, 23	—	3.1	—	—	—	3.1
22, 23	3.4	3.8	—	—	—	7.2
22, 33	—	4.2	—	—	—	4.2
12, 13, 22	—	—	—	—	—	—
12, 22	—	—	3.4	—	—	3.4
13, 20, 22	—	9.1	—	—	—	9.1
13, 20, 22, 23	—	—	—	—	—	—
13, 22	3.5	—	—	—	—	3.5
13, 22, 23	—	—	3.0	—	—	3.0
13, 22, 33	—	—	—	—	—	—
20, 22	3.4	6.9	8.4	—	—	18.7
20, 22, 23	—	3.4	1.2	—	—	4.6
TOTAL	47.0	165.0	100.9	14.4	4.4	331.7

TABLE 102.
Area of commercial softwood timberland by treatment
opportunity group and timberland quality class,
Sanders County, Working Circle 1 (thousand acres).

Treatment Opportunity	Timberland Quality Class				Total
	Excellent	Good	Fair	Poor	
	thousand acres				
10	12.9	29.4	11.9	3.0	57.2
11	15.6	17.0	13.2	4.6	50.3
12	2.8	—	1.4	—	4.2
13	—	3.3	—	—	3.3
20	3.0	6.4	10.2	3.3	22.9
21	4.8	3.1	9.2	—	17.1
22	5.8	16.3	12.1	0.4	34.5
23	13.6	18.9	7.1	0.4	39.9
30	10.7	6.3	1.8	3.0	21.9
32	—	—	—	—	—
33	—	—	1.4	0.4	1.8
40	4.2	4.2	—	—	8.5
12, 13	—	—	—	—	—
13, 20	—	3.9	—	—	3.9
13, 20, 23	—	—	—	—	—
13, 21	—	—	—	—	—
13, 23	4.8	—	—	—	4.8
13, 33	—	—	4.8	—	4.8
20, 23	—	3.1	—	—	3.1
22, 23	—	3.4	0.4	3.4	7.2
22, 33	—	4.2	—	—	4.2
12, 13, 22	—	—	—	—	—
12, 22	3.4	—	—	—	3.4
13, 20, 22	—	9.1	—	—	9.1
13, 20, 22, 23	—	—	—	—	—
13, 22	—	—	3.5	—	3.5
13, 22, 23	3.0	—	—	—	3.0
13, 22, 33	—	—	—	—	—
20, 22	5.2	6.9	3.7	2.8	18.7
20, 22, 23	—	—	3.4	1.2	4.6
TOTAL	89.8	135.4	84.2	22.4	331.7

TABLE 103.
Area of commercial softwood timberland by treatment
class and timberland quality class, Sanders County,
Working Circle 1 (thousand acres).

	Timberland Quality Class				Total
	Excellent	Good	Fair	Poor	
	thousand acres				
Stand Treatment Class					
Harvest-high risk	12.9	29.4	11.9	3.0	57.2
Harvest-low risk	15.6	17.0	13.2	4.6	50.3
Commercial thinning	6.2	—	1.4	—	7.6
Overstory removal	7.8	16.2	8.3	—	32.4
Precommercial thinning	8.2	29.3	17.3	7.4	62.2
Stand conversion	4.8	3.1	9.2	—	17.1
Sanitation	17.3	39.9	23.1	7.8	88.1
Regeneration of understocked areas	21.4	25.4	10.8	5.0	62.6
No treatment due to productive condition	10.7	6.3	1.8	3.0	21.9
No treatment-inoperable	—	—	—	—	—
No treatment-deferred until merchantable	—	4.2	6.3	0.4	10.9
Unknown-poor crowns, good growth	4.2	4.2	—	—	8.5
TOTAL	109.1	175.0	103.3	31.2	418.8

CONCLUSIONS AND RECOMMENDATIONS

OVERVIEW OF THE CURRENT GRAZABLE FOREST LAND RESOURCE

The amount and location of grazable forest acreage changes from year to year as new stands are logged and as crown densities in existing timber stands increase and block out the sun. In 1977, approximately 1,191,000 acres of the commercial forest in Working Circle 1 had less than 71 percent crown density and, therefore, were considered grazable. The condition of the forest understory was estimated to be good or excellent on 1,008,000 acres of the commercial forest, or 85 percent of the total grazable area. Forest lands with crown densities of 0-30 percent were the most overused. Nearly one-third of the area was in fair or poor condition at the time of sampling.

About 153,600 acres of privately owned forest lands were in fair or poor condition when sampled. If the condition of these lands is not improving, their stocking rates may need to be reevaluated. Another 29,100 acres of sampled publicly owned forest lands were in fair or poor condition and may also need grazing management changes.

The total carrying capacity or recommended animal stocking rate for sampled commercial timberlands in Working Circle 1 was estimated to be 193,037 animal unit months (AUMs) in 1977. Over half of these AUMs (60 percent) occurred on Douglas-fir climax forest land.

If every acre of grazable timberland were in excellent condition, the potential available carrying capacity would have been 252,479 AUMs. The actual available carrying capacity was 76 percent of the potential available carrying capacity.

Reducing utilization cuts through management techniques such as salting, herd-

ing, fencing, increasing the number of trails, increasing water developments, and reducing slash and debris can significantly increase the amount of available forage on at least 218,000 acres of grazable timberland.

OVERVIEW OF THE CURRENT TIMBER RESOURCE

At the time of this inventory, about 1.6 million acres (62 percent) of the sampled lands in Working Circle 1 were forested. Nonreserved commercial timberlands encompassed 1,581,000 acres. The top four owners of sampled commercial timberland were: forest industries--52 percent, other private individuals--24 percent, state agencies--18 percent, and farmer-ranchers--6 percent (see table 2 on page 14).

Almost 2.8 billion net cubic feet (8.7 billion net board feet) of timber was found on sampled nonreserved commercial timberlands. Douglas-fir and western larch contained 57 percent of the total board-foot volume.

The average commercial timberland acre held 5,500 net board feet of timber. State and other public lands had the highest average volume per acre--7,100 net board feet.

Only 20,600 acres (1.3 percent) of the commercial timberlands in the working circle were nonstocked in 1977. Stands classified as sawtimber occupied 917,100 acres, or about 58 percent of the total forest acreage. The average acre of softwood sawtimber held 8,300 board feet of timber.

Even though 58 percent of the commercial forest was in sawtimber stands, many

of the stands had lower volumes per acre than would be expected for sawtimber stands in northwestern Montana. Large amounts of acreage were in the lower stand volume classes. About 53 percent of the commercial timberland held less than 5,000 board feet per acre. Stands containing 10,000 or more board feet per acre occurred on 347,600 acres, or only 22 percent of the commercial timberland. The other private ownership group had the highest percentage of its timberland in the lower stand volume classes. Sixty-eight percent (327,800 acres) of these commercial timberlands contained less than 5,000 board feet per acre, while only 11 percent (53,000 acres) had more than 10,000 board feet per acre.

In 1977, annual net growth was estimated to be 65.9 million net cubic feet or 208.4 million net board feet Scribner. Annual mortality was estimated to be almost 13 million net cubic feet, or 34.3 million net board feet. Mortality is now probably higher because the bark beetle epidemics in pine and spruce have expanded since that time.

The average commercial forest acre has the potential to grow 79 cubic feet of wood per year. For Montana, and especially the Rocky Mountain region, this growth rate is very good. According to recent unpublished data compiled by the statewide forest inventory, state and private forest lands in Working Circle 1 have the highest potential productivity of any working circle in the state.

Insects and diseases were weakening trees on 580,300 acres (37 percent) of commercial timberland in 1977. This figure has also probably increased due to the expanded infestation of mountain pine beetles and spruce bark beetles since that time.

Softwood stands on commercial timberlands were quite young overall; stands on 58 percent of these lands (904,900 acres) were between 41 and 100 years old, while stands on only 29 percent (455,600 acres) were over 100 years old. The other private ownership group had the largest percentage of these young stands--79 percent

(365,400 acres) of the softwood forest lands owned by this group held stands 41 to 100 years old; only 8 percent (35,700 acres) had stands over 100 years old.

The average breast height age* by diameter class is much older than would be expected in a forest managed for sawlog production (see table 121 in Appendix 1). The range of breast height ages by diameter class also indicates that many small diameter trees (less than 11.0 inches at d.b.h.) are very old for their size. The condition may have been caused by overstocking, past harvesting practices, or natural successional development of sampled stands.

In 1977, about one-third of the commercial timberland area was improperly stocked for achieving optimum board feet production--270,700 acres were understocked and 258,900 acres were overstocked (see table 52). Table 119 in appendix 1 shows that almost one out of five live trees (19 percent) was a cull tree.

Based on the timberland quality class analysis, 75 percent of the softwood commercial timberland is rated as excellent or good for timber production; only 5 percent is rated as poor.

When this inventory was conducted, silvicultural treatment opportunities for improving forest condition and timber production were available on about 70 percent (1,087,200 acres) of the softwood commercial timberlands in Working Circle 1. Treatment opportunities besides harvesting were available on 52 percent (810,700 acres) of these acres.

If harvest categories are not included, the most common treatment opportunities on timberlands rated as excellent or good for producing timber were: sanitation--258,400 acres; precommercial thinning--228,800 acres; overstory removal--204,600 acres; and regeneration of understocked areas--173,900 acres.

*Breast height age is the age of the tree determined when it is bored 4.5 feet above the ground. This age does not account for the number of years it took the tree to grow to a height of 4.5 feet.

PAST HARVEST RATES

Each year, the Forestry Division attempts to determine the amount of timber harvested on state and private lands. This amount is determined from state land records and hazard reduction agreements drawn between the state and logging operators. The volumes listed in tables 104 and 105 reflect the board-foot volumes of timber loaded on trucks and delivered to mills. The smallest trees delivered are in the 6-inch diameter class. In addition to the volume brought to the mills, a portion of the merchantable volume is left in the forest as logging residue. Based on figures reported by the USDA Forest Service for western Montana and northern Idaho (Wilson et al. 1970), the

amount of residue left on the logging site is about 7 percent of the board-foot volume delivered to the mills. Timber also is harvested for railroad ties, posts, poles, rails, and firewood (cord wood). The amount of timber harvested for these uses is shown in table 106 for 1979 and 1980. The data show that the amount of timber harvested for those uses is small compared to the amount harvested for other forest products.

Data covering a 13-year cutting period (see table 104 and figure 16) show that timber harvesting generally increased on private lands until 1979 and 1980. The currently depressed housing market, caused principally by high interest rates, has decreased harvesting rates. The average amount of timber harvested on private land in Working Circle 1 over the

TABLE 104.
Volume of sawtimber cut from private lands, calendar
years 1968 through 1981 by county, Working Circle 1
(thousand board feet Scribner).

Year	County				Total
	Flathead	Lake	Lincoln	Sanders	
	thousand board feet				
1968	70,387	21,140	95,636	45,400	232,564
1969	47,318	18,904	85,750	48,386	200,357
1970	53,142	12,964	71,105	49,359	186,570
1971	67,040	12,316	127,619	36,936	243,910
1972	73,639	17,147	92,356	41,859	225,000
1973	62,070	7,101	61,250	58,928	189,349
1974	98,659	13,911	68,631	57,316	238,517
1975	98,405	16,155	91,953	71,889	278,402
1976	82,732	14,933	102,525	81,200	281,391
1977	88,735	9,670	94,077	89,054	281,535
1978	89,321	10,699	105,593	92,563	298,175
1979	76,590	8,837	93,602	80,266	259,295
1980	93,055	12,051	63,115	57,088	225,308
1981	84,280	9,753	97,423	51,065	242,521
TOTAL	1,085,371	185,580	1,250,635	861,307	3,382,893
14-year average	77,526	13,256	89,331	61,522	241,635

13 years was 241.6 million board feet. Lincoln and Flathead counties supplied 69 percent of the total volume of timber harvested from private lands during the period.

The amount of volume harvested from state and other public lands over the past 13 years (1968 - 1980) averaged 19.8 million board feet per year (see figure 18). State lands in Flathead County supplied a little over half of this volume (see table 105). The amount of timber harvested from state lands is tied closely to administrative budgets and, occasionally, the severity of the fire season.

CURRENT TIMBER SUPPLIES

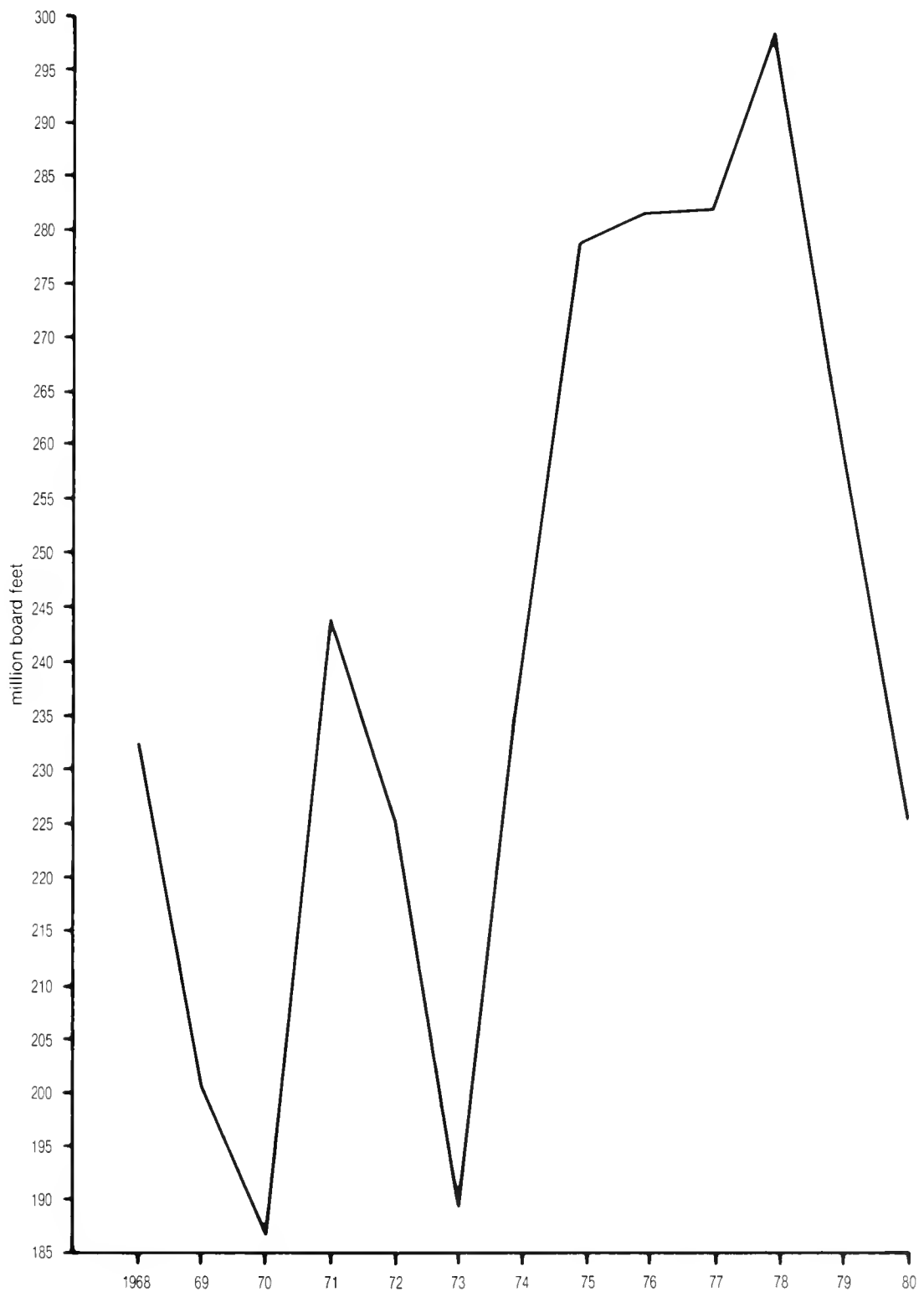
In 1977, the estimated softwood volume of timber on forest industry-owned lands totaled 4,975 million net board feet Scribner. Other privately owned timberlands held an estimated softwood volume of 1,661 million net board feet Scribner. State and other public lands held a softwood volume of 1,975 million net board feet Scribner. Of the 8,612 million net board feet standing on sampled public and private lands, 6,856 million board feet were on commercial timberlands rated as

TABLE 105.
Volume of sawtimber cut from state lands*, fiscal
years 1968 through 1980 by county, Working Circle 1
(thousand board feet Scribner).

Fiscal Year	County				Total
	Flathead	Lake	Lincoln	Sanders	
	thousand board feet				
1968	9,270	7,194	9,293	6,143	31,900
1969	17,828	12,718	9,650	188	40,384
1970	18,917	2,284	943	85	22,229
1971	13,403	2,515	2,221	143	18,282
1972	9,943	2,958	7,063	1,804	21,768
1973	8,590	5,567	8,380	168	22,705
1974	2,655	2,884	358	255	6,152
1975	4,218	1,650	2,493	220	8,581
1976	4,155	596	1,384	592	6,727
1977	7,031	3,225	2,096	1,950	14,302
1978	9,596	305	7,453	3,041	20,395
1979	15,506	—	5,340	2,808	23,654
1980	11,667	4,654	2,916	928	20,165
TOTAL	132,778	46,549	59,590	18,325	257,242
13-year average	10,214	3,581	4,584	1,410	19,788

*State lands are defined in this table as the timberland administered by the DSL. The amount of acreage involved includes 98 percent of the commercial timberland sampled in the state and other public ownership group. The volumes shown in this table do not include the amount harvested through special permits.

FIGURE 18. Volume cut from private lands, calendar years 1968 through 1980, Working Circle 1 (million board feet).



excellent or good for timber production (see table 113).

Unfortunately, over half of the commercial timberland area (53 percent) had less than 5,000 net board feet Scribner per acre, and only 22 percent of these timberlands had 10,000 or more board feet per acre. Nevertheless, 22 percent does represent about 347,600 acres, which is equivalent to a little over 543 square miles of heavily timbered land.

Harvest rates on private lands have averaged about 241.6 million board feet per year over the last 14 years. If logging residues are included, the average amount of timber removed from the timber inventory has been 258.5 million board feet per year.

The amount of timber removed from the private land inventory totaled 301.2 million board feet in 1977 (this figure includes logging residues). The net annual board-foot growth for sawtimber softwood species on private lands was estimated to be 162.2 million board feet that year. An additional 5.2 million board feet was produced by hardwood species. Thus, a total net board foot growth of 167.4 million board feet occurred on these lands. Subtracting net growth from harvested volume shows that the standing inventory of timber was reduced by 133.8 million board feet. In other words, harvesting in 1977 occurred at a rate that was 180 percent of board-foot net growth.

The net board-foot growth estimate does not include the board-foot growth produced by softwood trees smaller than 9.0 inches d.b.h. or hardwood trees smaller than 11.0 inches d.b.h. Net growth in softwood trees 5.0 to 8.9 inches d.b.h. totaled 30.0 million cubic feet. Of this net growth, produced by an estimated 134.2 million trees, 21.4 million cubic feet occurred in trees in the 6-inch diameter class.

Some or all of the board foot growth produced by poletimber size trees could be considered nullified--for comparison purposes--based on the fact that not all of the timber on private lands is available for harvest. According to the timber availability analysis (see tables 52 and

53), 17 percent of the timber inventoried is not available for harvest due to non-timber resource uses and constraints.

Since 1977, harvesting on private lands has continued to produce well above 200 million board feet of timber annually. Annual net board-foot growth may have declined since 1977 because bark beetle activity and associated mortality rates have increased. Although the supply of available sawtimber is enough to support harvesting in excess of growth for many years to come, it cannot do so indefinitely. Eventually, the net growth rate for private timberlands must be increased to avoid a reduction in supply from these lands in the future.

FUTURE TIMBER SUPPLIES

The future supply of timber from private lands will depend, to a large extent, on the intensity of forest management now and in the future. A large amount of the privately owned commercial forest is still in a formative stage; thus, it can be manipulated to greatly increase future timber production.

Forest managers can increase timber production in the near future by salvaging those trees that are already dead and by harvesting timber weakened by insects and disease. Commercial thinning also could help increase production, but according to the treatment opportunities analysis conducted during this inventory, only about 33,200 acres are suitable for this treatment (see table 51). Production could be further increased through improved use of the timber harvested. Employing the latest harvesting and milling technologies would increase the board-foot volume recoverable per tree harvested. These technologies include more efficient log manufacturing, smaller saw kerfs, and a more efficient first cut by the sawyer. Some mills currently can saw smaller diameter logs, which increases production because more of each tree can be used and because smaller trees can be economically harvested.

Several silvicultural treatment opportunities exist to increase timber produc-

tion in the distant future. According to this inventory's treatment opportunity analysis, about 70 percent (1,087,200 acres) of the softwood commercial timberlands in Working Circle 1 offer some type of silvicultural treatment opportunity (see table 46). Treatment opportunities besides harvesting are available on 52 percent (810,700 acres) of the softwood forest. These opportunities include: sanitation--347,800 acres; precommercial thinning--310,100 acres; regeneration of understocked areas--259,700 acres; and overstory removal--256,200 acres (see table 51).

A major factor that will affect future yields of timber from private forest lands will be the amount of the commercial timberland contained in relatively small land holdings. Generally, as forest lands are subdivided and decrease in size, the owners become less willing to sell their timber. Thus, as more of the forest land is developed and subdivided into smaller parcels, more and more of the timber becomes physically and economically unavailable for harvesting.

When this inventory was conducted, 24 percent of the sampled commercial timberlands were placed in the other private-individual ownership class. This owner-

ship class is made up almost entirely of private land owners with holdings of 40 acres or less. Information and education programs could make these landowners more aware of forest management opportunities. Unfortunately, many individuals need to be contacted before much forest acreage can be treated.

Timber production will be a major and probably a primary use of the land for two-thirds of the commercial timberlands on state and private lands in Working Circle 1. The outlook for timber production on the remaining third owned by non-forest industry private landowners is unclear. Getting the small forest landowner to use aggressive timber management practices is difficult. It remains to be seen how well that challenge will be met.

Finally, it must be reemphasized that the current rate of harvesting on private land cannot continue indefinitely with existing growth rates. This point brings forth the following question: Will net growth increase sufficiently under current forest management practices or will management have to be intensified? This question needs to be addressed in the near future. If a decline in the private land timber supply should become a reality, the economic impact could be

TABLE 106.
Miscellaneous forest products cut from private
lands in 1979 and 1980, Working Circle 1.

Year	Product			
	Ties	Posts	Poles	Cords
1979	15,838	2,774	—	—
1980	25,927	31,131	23,395	13,260
TOTAL	41,765	33,905	23,395	13,260

extensive. To lessen the impact, it would be necessary to harvest more timber from federal and state timberlands.

Silvicultural treatment opportunities exist to dramatically increase the growth rates and thereby possibly eliminate any

potential timber supply reduction from private land. The extent to which these opportunities are realized, beginning immediately, will determine the amount of timber available for harvest in the future.

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APPENDIX 1

ADDITIONAL SURVEY INFORMATION

TABLE 107.
Area of commercial timberland by stand volume class,
Working Circle 1 (thousand acres).

Cubic Foot/Acre Volume Class	Ownership Group				
	State and Other Public	Forest Industry		Other Private	Total
	%	thousand acres	%		%
Less than 500	28.9	160.3	19.6	92.7	281.9
500 - 1,499	76.8	210.1	25.6	185.0	471.9
1,500 - 2,499	82.5	211.6	25.8	141.3	435.5
2,500 - 3,499	49.5	116.8	14.3	37.2	203.5
3,500 - 4,999	28.9	90.6	11.0	16.0	135.5
Over 5,000	14.2	30.0	3.7	8.4	52.6
TOTAL	280.8	819.4	100.0	480.6	1,580.8
	100.0			100.0	100.0

TABLE 108.
Area of commercial timberland by forest type,
stand size class, and site class for the state and other public
ownership group, Working Circle 1 (acres).

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	acres					
Douglas-fir						
Sawtimber	—	10,723	30,457	39,583	4,302	85,065
Poletimber	—	—	3,441	7,915	1,898	13,254
Sapling, Seedling	—	—	4,130	7,544	1,453	13,127
Nonstocked	—	—	—	1,996	—	1,996
TOTAL	—	10,723	38,028	57,038	7,653	113,442
Lodgepole pine						
Sawtimber	—	—	5,827	10,005	4,522	20,354
Poletimber	815	115	6,377	14,915	58	22,280
Sapling, Seedling	—	2,821	47	4,237	2,342	9,447
Nonstocked	—	—	—	—	—	—
TOTAL	815	2,936	12,251	29,157	6,922	52,081
Ponderosa pine						
Sawtimber	1,447	1,499	1,593	1,670	641	6,850
Poletimber	—	33	1,447	24	—	1,504
Sapling, Seedling	—	—	606	2,638	33	3,277
Nonstocked	—	—	—	320	—	320
TOTAL	1,447	1,532	3,646	4,652	674	11,951
Western larch						
Sawtimber	80	1,462	5,845	12,420	1,453	21,260
Poletimber	—	—	2,211	815	—	3,026
Sapling, Seedling	—	—	3,272	2,749	1,854	7,875
Nonstocked	—	—	—	682	—	682
TOTAL	80	1,462	11,328	16,666	3,307	32,843

TABLE 108. (cont'd.)

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	— acres —					
Western hemlock						
Sawtimber	—	—	22	—	—	22
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	22	—	—	22
Whitebark pine						
Sawtimber	—	—	—	791	1,405	2,196
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	791	1,405	2,196
Western white pine						
Sawtimber	—	—	—	—	—	—
Poletimber	—	58	—	—	—	58
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	58	—	—	—	58
Juniper						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	—	—	—

TABLE 108. (cont'd.)

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	— acres —					
Subalpine fir						
Sawtimber	—	1,405	9,832	11,218	4,202	26,657
Poletimber	—	—	682	—	—	682
Sapling, Seedling	—	—	2,724	7,683	2,595	13,002
Nonstocked	—	—	—	—	—	—
TOTAL	—	1,405	13,238	18,901	6,797	40,341
Grand fir						
Sawtimber	—	2,809	4,378	2,838	—	10,025
Poletimber	—	—	1,405	—	—	1,405
Sapling, Seedling	—	—	2,059	792	—	2,851
Nonstocked	—	—	—	—	—	—
TOTAL	—	2,809	7,842	3,630	—	14,281
Engelmann spruce						
Sawtimber	—	1,462	2,965	2,792	—	7,219
Poletimber	—	—	22	849	—	871
Sapling, Seedling	—	—	—	1,723	—	1,723
Nonstocked	—	—	—	—	—	—
TOTAL	—	1,462	2,987	5,364	—	9,813
Western redcedar						
Sawtimber	—	—	125	1,453	—	1,578
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	125	1,453	—	1,578

TABLE 108. (cont'd.)

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	acres					
Total softwoods						
Sawtimber	1,527	19,360	61,044	82,770	16,525	181,226
Poletimber	815	206	15,585	24,518	1,956	43,080
Sapling, Seedling	—	2,821	12,838	27,366	8,277	51,302
Nonstocked	—	—	—	2,998	1,326	4,324
TOTAL	2,342	22,387	89,467	137,652	28,084	279,932
Aspen						
Sawtimber	—	80	—	—	—	80
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	80	—	—	—	80
Cottonwood						
Sawtimber	—	—	320	—	397	717
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	320	—	397	717
Other hardwoods						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	24	—	24
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	24	—	24
Total hardwoods						
Sawtimber	—	80	320	—	397	797
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	24	—	24
Nonstocked	—	—	—	—	—	—
TOTAL	—	80	320	24	397	821
All types						
Sawtimber	1,527	19,440	61,364	82,770	16,922	182,023
Poletimber	815	206	15,585	24,518	1,956	43,080
Sapling, Seedling	—	2,821	12,838	27,390	8,277	51,326
Nonstocked	—	—	—	2,998	1,326	4,324
TOTAL	2,342	22,467	89,787	137,676	28,481	280,753

TABLE 109.
Area of commercial timberland by forest type,
stand size class, and site class for the forest industry
ownership group, Working Circle 1 (acres).

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	acres					
Douglas-fir						
Sawtimber	—	26,369	68,906	150,356	25,860	271,491
Poletimber	—	—	—	22,193	12,949	35,142
Sapling, Seedling	—	—	9,112	29,462	34,587	73,161
Nonstocked	—	—	—	4,332	—	4,332
TOTAL	—	26,369	78,018	206,343	73,396	384,126
Lodgepole pine						
Sawtimber	—	4,269	17,271	30,538	338	52,416
Poletimber	—	4,320	20,111	47,496	8,747	80,674
Sapling, Seedling	—	—	—	16,304	24,316	40,620
Nonstocked	—	—	—	—	—	—
TOTAL	—	8,589	37,382	94,338	33,401	173,710
Ponderosa pine						
Sawtimber	—	—	12,929	30,332	676	43,937
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	8,607	7,139	15,746
Nonstocked	—	—	4,426	338	2,881	7,645
TOTAL	—	—	17,355	39,277	10,696	67,328
Western larch						
Sawtimber	—	4,320	21,386	17,598	—	43,304
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	4,258	11,638	4,321	20,217
Nonstocked	—	—	—	—	—	—
TOTAL	—	4,320	25,644	29,236	4,321	63,521

TABLE 109. (cont'd.)

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	acres					
Subalpine fir						
Sawtimber	—	4,269	4,269	—	—	8,538
Poletimber	—	—	4,426	—	—	4,426
Sapling, Seedling	—	—	—	20,611	5,102	25,713
Nonstocked	—	—	—	—	—	—
TOTAL	—	4,269	8,695	20,611	5,102	38,677
Grand fir						
Sawtimber	4,269	—	21,661	13,002	—	38,932
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	4,426	4,426	—	—	8,852
Nonstocked	—	—	—	—	—	—
TOTAL	4,269	4,426	26,087	13,002	—	47,784
Engelmann spruce						
Sawtimber	—	—	13,071	4,269	—	17,340
Poletimber	—	—	—	4,320	—	4,320
Sapling, Seedling	—	—	—	409	—	409
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	13,071	8,998	—	22,069
Western redcedar						
Sawtimber	—	—	8,538	4,320	—	12,858
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	8,538	4,320	—	12,858

TABLE 109. (cont'd.)

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	acres					
Western hemlock						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	4,258	—	—	4,258
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	4,258	—	—	4,258
Whitebark pine						
Sawtimber	—	—	—	—	4,332	4,332
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	—	4,332	4,332
Western white pine						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	—	—	—
Juniper						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	—	—	—

TABLE 109. (cont'd.)

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	acres					
Total softwoods						
Sawtimber	4,269	39,227	168,031	250,415	31,206	493,148
Poletimber	—	4,320	24,537	74,009	21,696	124,562
Sapling, Seedling	—	8,684	17,796	87,031	75,465	188,976
Nonstocked	—	—	4,426	4,670	2,881	11,977
TOTAL	4,269	52,231	214,790	416,125	131,248	818,663
Aspen						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	—	—	—
Cottonwood						
Sawtimber	—	—	338	—	409	747
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	338	—	409	747
Mixed hardwoods						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	—	—	—
Total hardwoods						
Sawtimber	—	—	338	—	409	747
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	338	—	409	747
All types						
Sawtimber	4,269	39,227	168,369	250,415	31,615	493,895
Poletimber	—	4,320	24,537	74,009	21,696	124,562
Sapling, Seedling	—	8,684	17,796	87,031	75,465	188,976
Nonstocked	—	—	4,426	4,670	2,881	11,977
TOTAL	4,269	52,231	215,128	416,125	131,657	819,410

TABLE 110.
Area of commercial timberland by forest type,
stand size class, and site class for the other private
ownership group, Working Circle 1 (acres).

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	acres					
Douglas-fir						
Sawtimber	—	9,180	22,244	60,673	4,180	96,277
Poletimber	—	—	12,077	37,065	—	49,142
Sapling, Seedling	—	—	23,396	42,895	16,393	82,684
Nonstocked	—	—	—	—	—	—
TOTAL	—	9,180	57,717	140,633	20,573	228,103
Lodgepole pine						
Sawtimber	—	—	16,707	4,537	597	21,841
Poletimber	4,196	7,881	8,330	4,196	3,941	28,544
Sapling, Seedling	—	4,196	8,393	597	—	13,186
Nonstocked	—	—	—	—	—	—
TOTAL	4,196	12,077	33,430	9,330	4,538	63,571
Ponderosa pine						
Sawtimber	—	4,180	12,959	18,530	2,913	38,582
Poletimber	—	4,389	—	7,855	—	12,244
Sapling, Seedling	—	—	—	—	4,390	4,390
Nonstocked	—	—	—	597	3,658	4,255
TOTAL	—	8,569	12,959	26,982	10,961	59,471
Western larch						
Sawtimber	4,180	3,940	16,379	9,183	—	33,682
Poletimber	—	—	—	4,196	—	4,196
Sapling, Seedling	—	—	—	3,940	—	3,940
Nonstocked	—	—	—	—	—	—
TOTAL	4,180	3,940	16,379	17,319	—	41,818

TABLE 110. (cont'd.)

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	acres					
Subalpine fir						
Sawtimber	—	—	—	3,659	—	3,659
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	4,852	4,999	9,851
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	8,511	4,999	13,510
Grand fir						
Sawtimber	—	—	7,881	—	—	7,881
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	7,881	—	—	7,881
Engelmann spruce						
Sawtimber	—	3,941	3,940	4,269	—	12,150
Poletimber	—	—	3,806	3,940	—	7,746
Sapling, Seedling	—	—	—	5,703	—	5,703
Nonstocked	—	—	—	—	—	—
TOTAL	—	3,941	7,746	13,912	—	25,599
Western redcedar						
Sawtimber	—	—	12,839	—	—	12,839
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	12,839	—	—	12,839

TABLE 110. (cont'd.)

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	acres					
Western hemlock						
Sawtimber	—	—	3,806	—	—	3,806
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	3,806	—	—	3,806
Whitebark pine						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	—	—	—
Western white pine						
Sawtimber	—	—	—	—	—	—
Poletimber	—	3,940	—	—	—	3,940
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	3,940	—	—	—	3,940
Juniper						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	1,719	—	1,719
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	1,719	—	1,719

TABLE 110. (cont'd.)

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	acres					
Total softwoods						
Sawtimber	4,180	21,241	96,755	100,851	7,690	230,717
Poletimber	4,196	16,210	24,213	57,252	3,941	105,812
Sapling, Seedling	—	4,196	31,789	59,706	25,782	121,473
Nonstocked	—	—	—	597	3,658	4,255
TOTAL	8,376	41,647	152,757	218,406	41,071	462,257
Aspen						
Sawtimber	—	4,180	—	—	—	4,180
Poletimber	—	3,659	—	—	—	3,659
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	7,839	—	—	—	7,839
Cottonwood						
Sawtimber	—	—	597	—	5,703	6,300
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	597	—	5,703	6,300
Mixed hardwoods						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	4,196	—	4,196
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	4,196	—	4,196
Total hardwoods						
Sawtimber	—	4,180	597	—	5,703	10,480
Poletimber	—	3,659	—	—	—	3,659
Sapling, Seedling	—	—	—	4,196	—	4,196
Nonstocked	—	—	—	—	—	—
TOTAL	—	7,839	597	4,196	5,703	18,335
All types						
Sawtimber	4,180	25,421	97,352	100,851	13,393	241,197
Poletimber	4,196	19,869	24,213	57,252	3,941	109,471
Sapling, Seedling	—	4,196	31,789	63,902	25,782	125,669
Nonstocked	—	—	—	597	3,658	4,255
TOTAL	8,376	49,486	153,354	222,602	46,774	480,592

TABLE 111.
Area of commercial timberland by forest type, stand size class,
and site class, Working Circle 1 (acres).

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	acres					
Douglas-fir						
Sawtimber	—	46,272	121,607	250,612	34,342	452,833
Poletimber	—	—	15,518	67,173	14,847	97,538
Sapling, Seedling	—	—	36,638	79,901	52,433	168,972
Nonstocked	—	—	—	6,328	—	6,328
TOTAL	—	46,272	173,763	404,014	101,622	725,671
Lodgepole pine						
Sawtimber	—	4,269	39,805	45,080	5,456	94,610
Poletimber	5,012	12,317	34,818	66,607	12,745	131,499
Sapling, Seedling	—	7,017	8,440	21,138	26,657	63,252
Nonstocked	—	—	—	—	—	—
TOTAL	5,012	23,603	83,063	132,825	44,858	289,361
Ponderosa pine						
Sawtimber	1,447	5,679	27,482	50,531	4,230	89,369
Poletimber	—	4,423	1,448	7,878	—	13,749
Sapling, Seedling	—	—	606	11,244	11,562	23,412
Nonstocked	—	—	4,426	1,255	6,539	12,220
TOTAL	1,447	10,102	33,962	70,908	22,331	138,750
Western larch						
Sawtimber	4,260	9,723	43,609	39,201	1,453	98,246
Poletimber	—	—	2,210	5,012	—	7,222
Sapling, Seedling	—	—	7,530	19,653	6,175	33,358
Nonstocked	—	—	—	682	—	682
TOTAL	4,260	9,723	53,349	64,548	7,628	139,508
Subalpine fir						
Sawtimber	—	5,674	14,101	14,877	4,201	38,853
Poletimber	—	—	5,109	—	—	5,109
Sapling, Seedling	—	—	2,725	33,146	12,696	48,567
Nonstocked	—	—	—	—	—	—
TOTAL	—	5,674	21,935	48,023	16,897	92,529
Grand fir						
Sawtimber	4,269	2,809	33,920	15,840	—	56,838
Poletimber	—	—	1,405	—	—	1,405
Sapling, Seedling	—	4,426	6,485	792	—	11,703
Nonstocked	—	—	—	—	—	—
TOTAL	4,269	7,235	41,810	16,632	—	69,946

TABLE 111. (cont'd.)

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	acres					
Engelmann spruce						
Sawtimber	—	5,403	19,976	11,330	—	36,709
Poletimber	—	—	3,828	9,110	—	12,938
Sapling, Seedling	—	—	—	6,509	—	6,509
Nonstocked	—	—	—	—	—	—
TOTAL	—	5,403	23,804	26,949	—	56,156
Western redcedar						
Sawtimber	—	—	21,502	5,774	—	27,276
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	21,502	5,774	—	27,276
Western hemlock						
Sawtimber	—	—	3,827	—	—	3,827
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	4,258	—	—	—	4,258
Nonstocked	—	—	—	—	—	—
TOTAL	—	4,258	3,827	—	—	8,085
Whitebark pine						
Sawtimber	—	—	—	792	5,736	6,528
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	1,326	1,326
TOTAL	—	—	—	792	7,062	7,854
Western white pine						
Sawtimber	—	—	—	—	—	—
Poletimber	—	3,998	—	—	—	3,998
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	3,998	—	—	—	3,998
Juniper						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	1,719	—	1,719
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	1,719	—	1,719

TABLE 111. (cont'd.)

Forest type and stand-size class	Site Class (cubic feet/acre/year)					All Classes
	165+	120-164	85-119	50-84	20-49	
	acres					
Total softwoods						
Sawtimber	9,976	79,829	325,829	434,037	55,418	905,089
Poletimber	5,012	20,738	64,336	155,780	27,592	273,458
Sapling, Seedling	—	15,701	62,424	174,102	109,523	361,750
Nonstocked	—	—	4,426	8,265	7,865	20,556
TOTAL	14,988	116,268	457,015	772,184	200,398	1,560,853
Aspen						
Sawtimber	—	4,260	—	—	—	4,260
Poletimber	—	3,659	—	—	—	3,659
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	7,919	—	—	—	7,919
Cottonwood						
Sawtimber	—	—	1,255	—	6,509	7,764
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	—	—	—
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	1,255	—	6,509	7,764
Other hardwoods						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling, Seedling	—	—	—	4,220	—	4,220
Nonstocked	—	—	—	—	—	—
TOTAL	—	—	—	4,220	—	4,220
Total hardwoods						
Sawtimber	—	4,260	1,255	—	6,509	12,024
Poletimber	—	3,659	—	—	—	3,659
Sapling, Seedling	—	—	—	4,220	—	4,220
Nonstocked	—	—	—	—	—	—
TOTAL	—	7,919	1,255	4,220	6,509	19,903
All types						
Sawtimber	9,976	84,089	327,084	434,037	61,927	917,113
Poletimber	5,012	24,397	64,336	155,780	27,592	277,117
Sapling, Seedling	—	15,701	62,424	178,322	109,523	365,970
Nonstocked	—	—	4,426	8,265	7,865	20,556
TOTAL	14,988	124,187	458,270	776,404	206,907	1,580,756

TABLE 112.
Area of commercial timberland by salvable dead
volume class and county, Working Circle 1 (thousand acres).

Volume Class Net Cu. Ft./Acre	Acres By County				
	Flathead	Lake	Lincoln	Sanders	Total
	thousand acres				
None	303.4	95.0	271.0	191.2	860.6
1 - 100	128.8	31.6	97.8	68.7	326.9
101 - 200	82.1	18.8	65.9	37.2	204.0
201 - 300	31.2	16.3	24.6	22.0	94.1
301 - 400	19.6	4.1	13.1	9.8	46.6
401 - 500	5.6	4.3	5.6	1.8	17.3
501 - 600	2.9	0.2	1.1	—	4.2
601 - 700	2.2	1.0	2.2	3.4	8.8
701 - 800	4.4	—	2.7	—	7.1
801 - 900	2.3	—	0.5	—	2.8
901 - 1000	2.3	—	0.5	—	2.8
1001 - 1100	1.0	1.3	0.3	3.0	5.6
TOTAL	585.8	172.6	485.3	337.1	1,580.8

TABLE 113.
Net volume of sawtimber on softwood commercial
timberland by stand size class, timberland quality class,
and ownership group (thousand board feet Scribner).

		Timberland Quality Class				
		Excellent	Good	Fair	Poor	Total
		thousand board feet				
State and Other Public						
Stand Size Class						
Old growth sawtimber	446,983	347,551	278,555	99,219	1,172,308	
Young growth sawtimber	353,563	145,510	59,313	60,168	618,554	
Poletimber	29,460	55,341	11,148	17,005	112,955	
Seedlings and Saplings	29,715	40,990	3,973	7,442	82,121	
Nonstocked	—	1,276	231	1,254	2,761	
TOTAL	859,720	590,670	353,220	185,088	1,988,699	
Forest Industry						
Stand Size Class						
Old growth sawtimber	979,241	1,279,653	371,819	176,804	2,807,516	
Young growth sawtimber	879,728	446,110	311,655	2,611	1,640,103	
Poletimber	104,633	121,539	75,526	11,202	312,900	
Seedlings and Saplings	46,077	103,017	66,717	2,805	218,615	
Nonstocked	7,571	2,327	2,602	—	12,499	
TOTAL	2,017,249	1,952,647	828,318	193,421	4,991,634	
Other Private						
Stand Size Class						
Old growth sawtimber	43,559	57,569	114,099	9,749	224,977	
Young growth sawtimber	767,253	272,155	19,251	33,818	1,092,477	
Poletimber	98,194	114,821	31,139	—	244,154	
Seedlings and Saplings	30,930	50,029	25,397	24,782	131,138	
Nonstocked	—	774	1,412	—	2,186	
TOTAL	939,936	495,349	191,298	68,350	1,694,932	
Working Circle Totals						
Stand Size Class						
Old growth sawtimber	1,469,782	1,684,774	764,472	285,772	4,204,800	
Young growth sawtimber	2,000,544	863,775	390,219	96,597	3,351,135	
Poletimber	232,288	291,701	117,813	28,207	670,009	
Seedlings and Saplings	106,721	194,037	96,087	35,029	431,874	
Nonstocked	7,571	4,377	4,245	1,254	17,447	
TOTAL	3,816,905	3,038,665	1,372,836	446,859	8,675,265	

TABLE 114.
Net volume of salvable dead on commercial timberland
by condition of dead class, diameter class, and species,
Working Circle 1 (thousand cubic feet).

Condition of Dead Class				
Douglas-fir	Diameter Class	Defect-Mostly		Total
		No Defect	Physical Rot thousand cubic feet	
	5.0 - 6.9	676	751 3,002	4,429
	7.0 - 8.9	618	498 2,659	3,775
	9.0 - 10.9	230	847 1,410	2,487
	11.0 - 12.9	—	633 1,088	1,721
	13.0 - 14.9	364	100 1,756	2,220
	15.0 - 16.9	—	267 1,262	1,529
	17.0 - 18.9	—	102 994	1,096
	19.0 - 20.9	—	435 722	1,157
	21.0 - 22.9	—	— 223	223
	23.0 - 24.9	—	— 441	441
	25.0 - 26.9	—	— 293	293
	27.0 - 28.9	—	— 129	129
	29.0 +	—	140 970	1,110
	TOTAL	1,888	3,773 14,949	20,610
Lodgepole pine				
	5.0 - 6.9	5,450	1,988 6,244	13,682
	7.0 - 8.9	3,581	1,124 2,907	7,612
	9.0 - 10.9	492	957 1,297	2,746
	11.0 - 12.9	622	985 1,569	3,176
	13.0 - 14.9	1,137	130 —	1,267
	15.0 - 16.9	—	891 535	1,426
	17.0 - 18.9	—	— 502	502
	19.0 - 20.9	—	— 117	117
	21.0 - 22.9	—	— —	—
	23.0 - 24.9	—	139 —	139
	25.0 - 26.9	—	— —	—
	27.0 - 28.9	—	— —	—
	29.0 +	—	— —	—
	TOTAL	11,282	6,214 13,171	30,667

TABLE 114. (cont'd.)

Condition of Dead Class				
Ponderosa pine				
Diameter Class	No Defect	Defect-Mostly	Defect-Mostly	Total
		Physical	Rot	
		thousand cubic feet		
5.0 - 6.9	—	156	333	489
7.0 - 8.9	—	232	791	1,023
9.0 - 10.9	851	221	663	1,735
11.0 - 12.9	419	—	841	1,260
13.0 - 14.9	—	—	2,196	2,196
15.0 - 16.9	—	457	366	823
17.0 - 18.9	—	—	—	—
19.0 - 20.9	—	248	—	248
21.0 - 22.9	—	397	1,041	1,438
23.0 - 24.9	—	—	655	655
25.0 - 26.9	552	—	1,021	1,573
27.0 - 28.9	—	—	—	—
29.0 +	—	—	181	181
TOTAL	1,822	1,711	8,088	11,621
Western larch				
5.0 - 6.9	64	227	1,448	1,739
7.0 - 8.9	—	451	1,380	1,831
9.0 - 10.9	—	586	2,008	2,594
11.0 - 12.9	—	142	1,892	2,034
13.0 - 14.9	—	51	1,945	1,996
15.0 - 16.9	460	—	4,373	4,833
17.0 - 18.9	—	1,376	1,374	2,750
19.0 - 20.9	—	—	1,681	1,681
21.0 - 22.9	—	567	1,709	2,276
23.0 - 24.9	—	450	1,822	2,272
25.0 - 26.9	—	312	1,645	1,957
27.0 - 28.9	—	—	577	577
29.0 +	—	1,495	2,400	3,895
TOTAL	524	5,657	24,254	30,435

TABLE 114. (cont'd.)

		Condition of Dead Class		
All Other Softwoods		Defect-Mostly		
Diameter Class	No Defect	Physical	Rot	Total
		thousand cubic feet		
5.0 - 6.9	1,191	562	1,948	3,701
7.0 - 8.9	931	701	2,755	4,387
9.0 - 10.9	115	1,091	2,984	4,190
11.0 - 12.9	522	529	1,565	2,616
13.0 - 14.9	914	695	3,428	5,037
15.0 - 16.9	—	262	1,242	1,504
17.0 - 18.9	—	101	780	881
19.0 - 20.9	—	—	1,779	1,779
21.0 - 22.9	—	769	1,396	2,165
23.0 - 24.9	—	169	128	297
25.0 - 26.9	—	149	534	683
27.0 - 28.9	—	—	389	389
29.0 +	—	173	488	661
TOTAL	3,673	5,201	19,416	28,290

Total for All Softwoods

5.0 - 6.9	7,381	3,684	12,975	24,040
7.0 - 8.9	5,130	3,006	10,492	18,628
9.0 - 10.9	1,688	3,702	8,362	13,752
11.0 - 12.9	1,563	2,289	6,955	10,807
13.0 - 14.9	2,415	976	9,325	12,716
15.0 - 16.9	460	1,877	7,778	10,115
17.0 - 18.9	—	1,579	3,650	5,229
19.0 - 20.9	—	683	4,299	4,982
21.0 - 22.9	—	1,733	4,369	6,102
23.0 - 24.9	—	758	3,046	3,804
25.0 - 26.9	552	461	3,493	4,506
27.0 - 28.9	—	—	1,095	1,095
29.0 +	—	1,808	4,039	5,847
TOTAL	19,189	22,556	79,878	121,623

TABLE 115.
 Net volume of nonsalvageable dead on commercial
 timberland by diameter class and ownership group,
 Working Circle 1 (thousand cubic feet).

Diameter Class	Ownership Group			Total
	State and Other Public	Forest Industry	Other Private	
	thousand cubic feet			
6	672	833	701	2,206
8	915	1,387	860	3,162
10	1,421	2,118	338	3,877
12	1,040	2,058	801	3,899
14	1,522	1,477	444	3,443
16	1,089	1,856	322	3,267
18	907	1,935	440	3,282
20	644	2,519	361	3,524
22	824	3,010	177	4,011
24	672	2,200	284	3,156
26	252	2,183	39	2,474
28	264	1,935	170	2,369
30+	892	3,514	385	4,791
TOTAL	11,114	27,025	5,322	43,461

TABLE 116.
Ratio of net board foot Scribner volume to net cubic foot volume by
species and diameter class on commercial timberland, Working Circle 1.

Diameter Class	Douglas- fir	Lodgepole pine	Ponderosa pine	Western larch	Subalpine fir	Grand fir	Spruce	Western redcedar	Western hemlock	Whitebark pine	Western white pine	Total Softwoods
9.0 - 10.9	2.8	3.4	1.8	3.1	3.2	2.9	3.2	3.0	2.7	3.6	3.6	3.1
11.0 - 12.9	3.9	4.8	3.4	4.3	4.2	4.3	4.5	3.8	3.5	4.7	4.5	4.2
13.0 - 14.9	4.4	4.9	4.2	4.7	4.5	4.5	4.6	3.8	4.3	4.8	4.8	4.5
15.0 - 16.9	4.7	5.0	4.7	5.0	4.6	4.6	4.6	3.8	4.3	4.9	4.8	4.7
17.0 - 18.9	4.8	4.9	4.9	5.1	4.6	4.5	4.6	3.8	4.7	4.8	4.8	4.9
19.0 - 20.9	4.9	4.9	5.1	5.2	4.7	4.3	4.6	3.8	4.8	4.8	4.9	5.0
21.0 - 22.9	5.1	4.9	5.2	5.3	4.9	4.2	4.7	3.8	4.7	4.9	5.0	5.1
23.0 - 24.9	5.1	4.9	5.3	5.5	4.9	4.1	5.0	3.9	—	4.9	5.1	5.3
25.0 - 26.9	5.2	—	5.4	5.6	—	4.1	5.1	3.9	—	5.0	5.2	5.3
27.0 - 28.9	5.2	—	5.6	5.6	—	4.1	5.3	3.9	—	5.0	5.2	5.4
29+	5.2	—	5.9	5.5	—	4.1	5.4	4.1	—	—	5.3	5.5
Total sawtimber (All trees 9.0" + d.b.h.)	4.3	4.1	4.8	4.9	4.0	4.1	4.4	3.7	3.8	4.8	4.8	4.5
Total growing stock (All trees 5.0" + d.b.h.)	3.2	1.5	4.5	4.1	2.1	3.2	3.5	3.1	2.6	4.6	4.1	3.1

TABLE 117.

Net volume of growing stock on commercial timberland by primary habitat type group and species, Working Circle 1 (thousand cubic feet).

Primary Habitat Type Group	Softwood Species							
	Douglas- fir	Lodgepole pine	Ponderosa pine	Western larch	Subalpine fir	Grand fir	Spruce	Western hemlock
Habitat Group 1	—	—	—	—	—	—	—	—
Habitat Group 2	—	—	—	—	—	—	—	—
Habitat Group 3	—	—	12,684	—	—	—	—	—
Habitat Group 4	—	89	691	—	—	—	—	—
Habitat Group 5	7,786	—	13,541	—	—	—	—	—
Habitat Group 6	107,144	81,672	64,677	73,997	313	734	218	—
Habitat Group 7	168,054	3,801	37,411	25,450	118	689	453	—
Habitat Group 8	67,662	45,179	12,316	31,491	—	—	336	—
Habitat Group 9	91,299	653	53,516	3,373	—	—	—	—
Habitat Group 10	54,475	5,842	12,292	9,107	—	—	—	—
Habitat Group 11	19,953	965	20,524	3,752	—	—	—	—
Habitat Group 12	—	—	—	—	—	—	—	—
Habitat Group 13	28,586	39,778	754	21,230	293	—	16,981	—
Habitat Group 14	11,745	11,966	1,507	7,509	—	—	3,640	—
Habitat Group 15	182,188	103,951	32,632	112,114	5,164	70,495	26,931	1,082
Habitat Group 16	83,417	122,729	9,078	129,814	19,677	63,233	28,049	18,961
Habitat Group 17	767	17,058	1,027	4,370	—	—	20,454	—
Habitat Group 18	50,347	25,333	466	61,153	19,594	1,467	31,557	—
Habitat Group 19	3,882	16,107	—	7,027	—	—	—	—
Habitat Group 20	—	—	—	—	—	—	—	—
Habitat Group 21	4,830	15,989	—	3,177	10,205	—	16,037	—
Habitat Group 22	8,231	36,820	—	12,003	6,872	—	1,891	—
Habitat Group 23	1,290	43,647	—	5,352	3,012	—	339	—
Habitat Group 24	—	—	—	—	—	—	—	—
Habitat Group 25	—	—	—	—	—	—	—	—
Habitat Group 26	—	139	—	—	12,287	—	3,755	860
Habitat Group 27	—	—	—	—	308	—	—	—
Habitat Group 28	—	—	—	—	—	—	—	—
Habitat Group 29	—	—	—	—	—	—	—	—
TOTAL	891,656	571,718	273,116	510,919	77,843	136,618	150,641	20,903

*The western hemlock (*Tsuga heterophylla*) category also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

TABLE 117. (cont'd.)

Primary Habitat Type Group	Whitebark pine	Western white pine	Total Softwood Species	Hardwood Species				Total All Species
				Aspen	Cottonwood	Other Hardwoods	Total Hardwood	
				thousand cubic feet				
Habitat Group 1	—	—	—	—	—	—	—	—
Habitat Group 2	—	—	—	—	—	—	—	—
Habitat Group 3	—	—	12,684	—	—	—	—	12,684
Habitat Group 4	—	—	780	1,081	261	—	1,342	2,122
Habitat Group 5	—	—	21,327	—	—	—	—	21,327
Habitat Group 6	—	—	328,755	—	—	—	—	328,755
Habitat Group 7	—	—	235,976	1,249	128	880	2,257	238,233
Habitat Group 8	—	—	156,984	641	—	—	641	157,625
Habitat Group 9	—	—	148,841	—	—	—	—	148,841
Habitat Group 10	—	—	81,716	—	—	—	—	81,716
Habitat Group 11	—	—	45,194	—	285	—	285	45,479
Habitat Group 12	—	—	—	—	—	—	—	—
Habitat Group 13	—	—	107,622	10,326	1,161	1,710	13,197	120,819
Habitat Group 14	—	—	36,367	—	1,291	—	1,291	37,658
Habitat Group 15	369	2,104	537,556	—	1,460	9,017	10,477	548,033
Habitat Group 16	1,358	27,550	545,187	5,880	8,211	5,784	19,875	565,062
Habitat Group 17	—	—	43,676	471	1,402	—	1,873	45,549
Habitat Group 18	—	3,822	193,829	—	3,467	92	3,559	197,388
Habitat Group 19	—	—	27,016	—	—	—	—	27,016
Habitat Group 20	—	—	—	—	—	—	—	—
Habitat Group 21	2,732	1,393	54,363	—	—	—	—	54,363
Habitat Group 22	—	275	66,092	—	—	—	—	66,092
Habitat Group 23	—	—	53,640	—	—	—	—	53,640
Habitat Group 24	—	—	—	—	—	—	—	—
Habitat Group 25	—	—	—	—	—	—	—	—
Habitat Group 26	19,995	—	37,036	—	—	—	—	37,036
Habitat Group 27	171	—	479	—	—	—	—	479
Habitat Group 28	—	—	—	—	—	—	—	—
Habitat Group 29	—	—	—	—	—	—	—	—
TOTAL	24,625	35,144	2,735,120	19,648	17,666	17,483	54,797	2,789,917

TABLE 118.

Net volume of sawtimber on commercial timberland by primary habitat type group and species, Working Circle 1 (thousand board feet Scribner).

Softwood Species

Primary Habitat Type Group	Douglas-fir	Lodgepole pine	Ponderosa pine	Western larch	Subalpine fir	Grand fir	Spruce	Western redcedar	Western hemlock
	thousand board feet								
Habitat Group 1	—	—	—	—	—	—	—	—	—
Habitat Group 2	—	—	—	—	—	—	—	—	—
Habitat Group 3	—	—	38,449	—	—	—	—	—	—
Habitat Group 4	—	335	2,311	—	—	—	—	—	—
Habitat Group 5	24,861	—	62,581	—	—	—	—	—	—
Habitat Group 6	319,976	109,773	323,722	354,318	—	1,076	—	—	—
Habitat Group 7	487,325	6,183	137,279	71,872	—	683	1,857	—	—
Habitat Group 8	236,918	46,235	64,780	128,989	—	—	—	—	—
Habitat Group 9	256,396	3,298	235,713	13,561	—	—	—	—	—
Habitat Group 10	177,231	4,303	51,224	20,419	—	—	—	—	—
Habitat Group 11	38,577	3,635	92,773	9,595	—	—	—	—	—
Habitat Group 12	—	—	—	—	—	—	—	—	—
Habitat Group 13	96,719	63,161	4,383	81,002	293	—	42,514	—	—
Habitat Group 14	37,620	20,426	6,844	26,326	—	—	10,770	—	—
Habitat Group 15	635,192	116,554	168,736	473,307	6,580	202,995	60,777	1,015	3,965
Habitat Group 16	300,111	196,055	41,394	506,876	39,583	226,664	109,686	129,136	48,236
Habitat Group 17	3,170	30,484	6,261	19,800	—	—	79,569	—	—
Habitat Group 18	191,361	36,404	2,331	274,446	38,515	6,438	130,482	335	—
Habitat Group 19	12,239	34,475	—	27,593	—	—	—	—	—
Habitat Group 20	—	—	—	—	—	—	—	—	—
Habitat Group 21	21,796	43,963	—	12,732	30,903	—	68,691	—	—
Habitat Group 22	31,830	104,710	—	56,091	17,001	—	5,615	—	—
Habitat Group 23	2,220	13,155	—	14,692	1,416	—	1,140	—	—
Habitat Group 24	—	—	—	—	—	—	—	—	—
Habitat Group 25	—	—	—	—	—	—	—	—	—
Habitat Group 26	—	684	—	—	32,750	—	15,756	—	1,293
Habitat Group 27	—	—	—	—	423	—	—	—	—
Habitat Group 28	—	—	—	—	—	—	—	—	—
Habitat Group 29	—	—	—	—	—	—	—	—	—
TOTAL	2,873,542	833,833	1,238,781	2,091,619	167,171	437,856	526,857	130,486	53,494

*The western hemlock (*Tsuga heterophylla*) category also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

TABLE 118. (cont'd.)

Primary Habitat Type Group	Whitebark pine	Western white pine	Total Softwood Species	Hardwood Species				Total All Species
				Aspen	Cottonwood	Other Hardwoods	Total Hardwood	
				thousand board feet				
Habitat Group 1	—	—	—	—	—	—	—	—
Habitat Group 2	—	—	—	—	—	—	—	—
Habitat Group 3	—	—	38,449	—	—	—	—	38,449
Habitat Group 4	—	—	2,646	—	—	—	—	2,646
Habitat Group 5	—	—	87,442	—	—	—	—	87,442
Habitat Group 6	—	—	1,108,865	—	—	—	—	1,108,865
Habitat Group 7	—	—	705,199	—	—	—	—	705,199
Habitat Group 8	—	—	476,922	—	—	—	—	476,922
Habitat Group 9	—	—	508,968	—	—	—	—	508,968
Habitat Group 10	—	—	253,177	—	—	—	—	253,177
Habitat Group 11	—	—	144,580	—	1,169	—	1,169	145,749
Habitat Group 12	—	—	—	—	—	—	—	—
Habitat Group 13	—	—	287,779	10,122	5,038	—	15,160	302,939
Habitat Group 14	—	—	101,986	—	4,313	—	4,313	106,299
Habitat Group 15	—	8,479	1,677,600	—	1,628	4,235	5,863	1,683,463
Habitat Group 16	6,362	111,840	1,715,943	19,185	27,303	4,417	50,905	1,766,848
Habitat Group 17	—	—	139,284	2,094	5,930	—	8,024	147,308
Habitat Group 18	—	17,264	697,576	—	14,496	—	14,496	712,072
Habitat Group 19	—	—	74,307	—	—	—	—	74,307
Habitat Group 20	—	—	—	—	—	—	—	—
Habitat Group 21	13,033	6,600	197,718	—	—	—	—	197,718
Habitat Group 22	—	1,200	216,447	—	—	—	—	216,447
Habitat Group 23	—	—	32,623	—	—	—	—	32,623
Habitat Group 24	—	—	—	—	—	—	—	—
Habitat Group 25	—	—	—	—	—	—	—	—
Habitat Group 26	92,802	—	143,285	—	—	—	—	143,285
Habitat Group 27	401	—	824	—	—	—	—	824
Habitat Group 28	—	—	—	—	—	—	—	—
Habitat Group 29	—	—	—	—	—	—	—	—
TOTAL	112,598	145,383	8,611,620	31,401	59,877	8,652	99,930	8,711,550

TABLE 119.
Number of trees on commercial timberland by class of
timber and ownership group, Working Circle 1 (thousand trees).

Class of timber	Softwoods		Species Hardwoods		Total	
	No. trees	%	No. trees	%	No. trees	%
	<hr/> thousand trees <hr/>					
State and Other Public						
Desirable	90,450	41.3	4,294	68.1	94,744	42.1
Acceptable	82,615	37.8	1,486	23.6	84,101	37.3
Sound Cull	39,089	17.9	439	7.0	39,527	17.6
Rotten Cull	1,536	0.7	22	0.3	1,558	0.7
Salvable Dead*	5,121	2.3	63	1.0	5,184	2.3
TOTAL	218,811	100.0	6,304	100.0	225,115	100.0
Forest Industry						
Desirable	154,311	33.2	1,743	37.2	156,054	33.3
Acceptable	203,728	43.9	2,724	58.2	206,452	44.0
Sound Cull	95,123	20.5	120	2.6	95,244	20.3
Rotten Cull	1,796	0.4	96	2.0	1,892	0.4
Salvable Dead*	9,404	2.0	—	—	9,404	2.0
TOTAL	464,363	100.0	4,683	100.0	469,047	100.0
Other Private						
Desirable	94,199	39.1	18,473	56.8	112,672	41.2
Acceptable	97,882	40.6	12,426	38.2	110,308	40.3
Sound Cull	43,976	18.3	999	3.1	44,975	16.5
Rotten Cull	746	0.3	372	1.1	1,118	0.4
Salvable Dead*	4,172	1.7	247	0.8	4,419	1.6
TOTAL	240,975	100.0	32,517	100.0	273,492	100.0
Working Circle Totals						
Desirable	338,960	36.7	24,510	56.3	363,470	37.5
Acceptable	384,225	41.6	16,636	38.3	400,861	41.4
Sound Cull	178,188	19.3	1,558	3.6	179,746	18.6
Rotten Cull	4,078	0.4	490	1.1	4,568	0.5
Salvable Dead*	18,697	2.0	310	0.7	19,007	2.0
TOTAL	924,148	100.0	43,504	100.0	967,652	100.0

*The number of salvable dead trees includes only those trees with a d.b.h. of 5 inches and larger. The number of live trees by tree class includes all trees 2 inches at d.b.h. and larger.

TABLE 120.
Number of growing stock trees per acre on commercial
timberland by diameter class and stand size class, Working Circle 1.

Diameter Class	Stand Size Class					Overall Average
	Old Growth	Young Growth	Pole-	Seedlings	Nonstocked	
	Sawtimber	Sawtimber	t看	Saplings		
	average number of trees/acre					
1.0 - 2.9	153.98	139.09	248.21	286.00	0	194.02
3.0 - 4.9	61.20	90.51	198.38	143.41	0	113.41
5.0 - 6.9	39.93	60.80	167.26	41.77	0.80	69.24
7.0 - 8.9	29.90	37.52	81.17	14.23	2.83	37.49
9.0 - 10.9	22.41	25.63	24.03	4.92	1.00	19.46
11.0 - 12.9	15.13	15.61	6.86	2.96	3.07	10.87
13.0 - 14.9	11.12	8.68	2.74	1.58	0.25	6.48
15.0 - 16.9	7.44	5.31	1.11	0.91	0.74	4.01
17.0 - 18.9	5.98	2.64	0.90	0.69	0.48	2.66
19.0 - 20.9	3.49	1.28	0.46	0.40	0.13	1.45
21.0 - 22.9	2.40	0.80	0.17	0.23	0	0.93
23.0 - 24.9	1.40	0.54	0.17	0.11	0.22	0.58
25.0 - 26.9	1.01	0.34	0.09	0.09	0	0.39
27.0 - 28.9	0.62	0.18	0.09	0.04	0	0.24
29.0 +	0.85	0.32	0.03	0.09	0.16	0.34
TOTAL	356.87	389.25	731.66	497.44	9.68	461.57

TABLE 121.
Average d.b.h. age by diameter class, species group
and MAI site class for growing stock trees on
commercial timberland, Working Circle 1.

Species Group: Douglas-fir

Diameter Class	MAI Site Class (cubic feet/acre/year)					
	20 - 49		50 - 84		85+	
	Age	Range	Age	Range	Age	Range
1.0 - 2.9*	59	31 - 100	47	21 - 90	44	21 - 80
3.0 - 4.9	66	21 - 110	55	21 - 90	50	21 - 90
5.0 - 6.9	73	21 - 160	68	21 - 200	65	31 - 160
7.0 - 8.9	83	31 - 180	79	31 - 200	71	21 - 180
9.0 - 10.9	109	51 - 200	96	31 - 200	85	31 - 200
11.0 - 12.9	144	51 - 200	107	31 - 200	83	31 - 200
13.0 - 14.9	163	71 - 200	123	41 - 200	104	41 - 200
15.0 - 16.9	179	71 - 200	132	31 - 200	112	41 - 200
17.0 - 18.9	178	121 - 200**	155	51 - 200	121	41 - 200
19.0 - 20.9	191	141 - 200**	159	71 - 200	143	41 - 200
21.0 - 22.9	195	191 - 200**	181	81 - 200	149	51 - 200
23.0 - 24.9	177	151 - 200**	181	131 - 200**	159	61 - 200
25.0 - 26.9	165	161 - 170**	191	111 - 200**	169	81 - 200
27.0 - 28.9	195	191 - 200**	185	121 - 200**	166	101 - 200**
29.0 - 30.9	—	—	195	191 - 200**	167	101 - 200**
31.0 - 32.9	195	191 - 200**	195	191 - 200**	167	91 - 200**
33.0 - 34.9	—	—	195	191 - 200**	195	191 - 200**
35.0 - 36.9	195	191 - 200**	—	—	177	151 - 200**
37.0 - 38.9	—	—	—	—	135	131 - 140**
39.0 +	—	—	195	191 - 200**	185	181 - 190**

*Ages recorded for the 2-inch diameter class are total tree ages.
All other diameter classes have d.b.h. age recorded for them.

**Indicates a very small sample is responsible for the estimates.

TABLE 121. (cont'd.)

Species Group: Lodgepole pine

Diameter Class	MAI Site Class (cubic feet/acre/year)					
	20 - 49		50 - 84		85+	
	Age	Range	Age	Range	Age	Range
1.0 - 2.9*	47	21 - 80	46	11 - 90	37	21 - 60
3.0 - 4.9	78	41 - 100	61	21 - 90	47	31 - 80
5.0 - 6.9	77	41 - 140	70	21 - 120	57	21 - 110
7.0 - 8.9	89	51 - 190	77	21 - 200	62	31 - 130
9.0 - 10.9	101	51 - 200	92	41 - 200	71	31 - 190
11.0 - 12.9	129	51 - 200	115	41 - 200	88	31 - 200
13.0 - 14.9	154	101 - 200	145	51 - 200	95	51 - 200
15.0 - 16.9	75	71 - 80**	149	61 - 190**	94	31 - 190
17.0 - 18.9	—	—	—	—	103	71 - 140**
19.0 - 20.9	—	—	—	—	80	61 - 100**
21.0 - 22.9	—	—	—	—	76	61 - 110**
23.0 - 24.9	195	191 - 200**	—	—	—	—
25.0 - 26.9	—	—	—	—	—	—
27.0 - 28.9	—	—	—	—	—	—
29.0 - 30.9	—	—	—	—	—	—
31.0 - 32.9	—	—	—	—	—	—
33.0 - 34.9	—	—	—	—	—	—
35.0 - 36.9	—	—	—	—	—	—
37.0 - 38.9	—	—	—	—	—	—
39.0 +	—	—	—	—	—	—

*Ages recorded for the 2-inch diameter class are total tree ages.
All other diameter classes have d.b.h. age recorded for them.

**Indicates a very small sample is responsible for the estimates.

TABLE 121. (cont'd.)

Species Group: Western larch, ponderosa pine, western white pine

Diameter Class	MAI Site Class (cubic feet/acre/year)					
	20 - 49		50 - 84		85+	
	Age	Range	Age	Range	Age	Range
1.0 - 2.9*	48	21 - 90	38	11 - 70	28	11 - 60
3.0 - 4.9	42	11 - 80	56	11 - 110	50	21 - 80
5.0 - 6.9	65	11 - 110	63	21 - 120	55	21 - 110
7.0 - 8.9	92	21 - 200	69	21 - 200	62	21 - 200
9.0 - 10.9	124	21 - 200	82	31 - 200	73	31 - 200
11.0 - 12.9	130	61 - 200	102	31 - 200	78	21 - 200
13.0 - 14.9	156	41 - 200	121	31 - 200	87	31 - 200
15.0 - 16.9	182	131 - 200	147	61 - 200	106	41 - 200
17.0 - 18.9	182	101 - 200**	152	31 - 200	136	41 - 200
19.0 - 20.9	173	101 - 200**	178	81 - 200	153	41 - 200
21.0 - 22.9	182	101 - 200**	181	71 - 200	171	51 - 200
23.0 - 24.9	177	71 - 200**	181	61 - 200	175	61 - 200
25.0 - 26.9	195	191 - 200**	191	111 - 200	187	51 - 200
27.0 - 28.9	195	191 - 200**	193	121 - 200**	182	61 - 200
29.0 - 30.9	195	191 - 200**	193	111 - 200**	194	181 - 200**
31.0 - 32.9	195	191 - 200**	195	191 - 200**	188	121 - 200**
33.0 - 34.9	195	191 - 200**	195	191 - 200**	195	191 - 200**
35.0 - 36.9	195	191 - 200**	195	191 - 200**	183	111 - 200**
37.0 - 38.9	—	—	195	191 - 200**	195	191 - 200**
39.0 +	—	—	195	191 - 200**	195	191 - 200**

*Ages recorded for the 2-inch diameter class are total tree ages.
All other diameter classes have d.b.h. age recorded for them.

**Indicates a very small sample is responsible for the estimates.

TABLE 121. (cont'd.)

Species Group: Grand fir, subalpine fir, spruce, western redcedar
western hemlock, mountain hemlock

Diameter Class	MAI Site Class (cubic feet/acre/year)					
	20 - 49		50 - 84		85+	
	Age	Range	Age	Range	Age	Range
1.0 - 2.9*	63	21 - 140	54	21 - 140	49	21 - 100
3.0 - 4.9	81	41 - 120	60	31 - 110	52	21 - 130
5.0 - 6.9	101	41 - 180	72	41 - 190	71	21 - 150
7.0 - 8.9	100	41 - 170	87	31 - 180	78	31 - 160
9.0 - 10.9	158	81 - 200	109	31 - 200	91	31 - 200
11.0 - 12.9	114	71 - 200	122	41 - 200	95	31 - 200
13.0 - 14.9	140	101 - 200	112	51 - 200	115	41 - 200
15.0 - 16.9	187	101 - 200	150	71 - 200	109	41 - 200
17.0 - 18.9	175	121 - 200**	146	81 - 200	123	51 - 200
19.0 - 20.9	—	—	180	71 - 200	146	61 - 200
21.0 - 22.9	—	—	188	161 - 200	166	81 - 200
23.0 - 24.9	—	—	190	181 - 200**	162	81 - 200
25.0 - 26.9	—	—	195	191 - 200**	166	71 - 200
27.0 - 28.9	—	—	195	191 - 200**	174	61 - 200
29.0 - 30.9	—	—	—	—	184	161 - 200**
31.0 - 32.9	—	—	—	—	195	191 - 200**
33.0 - 34.9	—	—	—	—	161	141 - 200**
35.0 - 36.9	—	—	—	—	195	191 - 200**
37.0 - 38.9	—	—	—	—	195	191 - 200**
39.0 +	—	—	—	—	195	191 - 200**

*Ages recorded for the 2-inch diameter class are total tree ages.
All other diameter classes have d.b.h. age recorded for them.

**Indicates a very small sample is responsible for the estimates.

TABLE 122.
Net volume of softwood sawtimber on commercial
timberland by diameter class and ownership group,
Working Circle 1 (thousand board feet Scribner).

Diameter Class	Ownership Group			Total
	State and Other Public	Forest Industry	Other Private	
	thousand board feet			
9.0 - 10.9	241,040	500,398	360,594	1,102,032
11.0 - 12.9	304,300	631,706	359,137	1,295,141
13.0 - 14.9	281,411	651,760	304,414	1,237,585
15.0 - 16.9	237,400	590,951	242,867	1,071,218
17.0 - 18.9	224,958	596,916	144,065	965,939
19.0 - 20.9	184,582	406,360	99,128	690,071
21.0 - 22.9	136,232	404,663	49,991	590,886
23.0 - 24.9	116,140	304,961	34,319	455,421
25.0 - 26.9	77,829	283,552	15,715	377,096
27.0 - 28.9	69,139	168,168	19,420	256,728
29.0 +	102,278	435,963	31,263	569,504
TOTAL	1,975,308	4,975,398	1,660,915	8,611,620

TABLE 123.

Net volume of growing stock on commercial timberland by diameter class and species, Working Circle 1 (thousand cubic feet).

Diameter Class	Species thousand cubic feet								
	Douglas- fir	Lodgepole pine	Ponderosa pine	Western larch	Subalpine fir	Grand fir	Spruce	Western redcedar	Western* hemlock
5.0 - 6.9	101,538	194,788	5,168	33,114	20,025	13,671	16,374	3,327	2,514
7.0 - 8.9	115,164	173,838	11,392	51,722	15,722	17,076	15,217	3,649	4,160
9.0 - 10.9	121,392	108,628	14,667	45,406	15,952	19,169	19,984	5,541	5,204
11.0 - 12.9	123,365	52,283	21,601	41,107	11,010	20,346	23,963	7,306	1,767
13.0 - 14.9	104,705	29,983	25,618	50,658	4,840	18,886	19,886	3,620	1,761
15.0 - 16.9	99,984	7,744	22,171	50,155	5,335	15,137	14,721	4,722	735
17.0 - 18.9	79,510	1,814	24,626	48,491	4,068	12,614	13,094	3,405	3,822
19.0 - 20.9	49,504	1,846	21,158	40,120	578	8,574	8,338	2,669	522
21.0 - 22.9	35,059	654	28,662	35,200	161	5,564	6,649	1,178	419
23.0 - 24.9	22,818	139	26,052	28,168	152	1,940	3,793	456	
25.0 - 26.9	14,618		20,802	28,784		1,506	3,053	1,001	
27.0 - 28.9	10,772		13,656	17,909		1,474	2,407	729	
29+	13,226		37,543	40,495		661	3,161	4,334	
ALL CLASSES	891,655		273,116	510,919	77,843	136,618	150,639	41,937	20,904

Diameter Class	Species thousand cubic feet							Total Hard- wood species	Total all species
	Whitebark limber pine	Western white pine	Total Soft- wood species	Aspen	Cottonwood	Other hardwoods			
5.0 - 6.9	485	2,064	393,067	2,343	839	6,633	9,816	402,883	
7.0 - 8.9	521	2,484	410,536	4,861	1,707	5,918	12,486	423,022	
9.0 - 10.9	1,143	3,013	360,098	5,230	949	2,929	9,108	369,206	
11.0 - 12.9	2,937	4,746	310,430	3,140	1,599	937	5,675	316,105	
13.0 - 14.9	5,248	7,285	272,492	362	1,782	148	2,291	274,783	
15.0 - 16.9	3,968	2,073	226,743	857	1,237	600	2,694	229,438	
17.0 - 18.9	4,047	3,513	199,003	915	1,959	93	2,967	201,970	
19.0 - 20.9	3,249	2,685	139,242	1,009	1,287		2,296	141,538	
21.0 - 22.9	1,578	454	115,580		373		373	115,953	
23.0 - 24.9	788	2,316	86,622		151	227	379	87,000	
25.0 - 26.9	389	376	70,529					70,529	
27.0 - 28.0	272	499	47,719	473	782		1,255	48,974	
29+		3,636	103,056	458	4,999		5,457	108,513	
ALL CLASSES	24,625	35,144	2,735,117	19,648	17,666	17,485	54,798	2,789,915	

*The western hemlock (*Tsuga heterophylla*) category also includes a small amount of mountain hemlock (*Tsuga mertensiana*).

TABLE 124.
Net volume of sawtimber on commercial timberland by diameter class and species, Working Circle 1 (thousand board feet Scribner).

Diameter Class	Species						
	Douglas- fir	Lodgepole pine	Ponderosa pine	Western larch	Subalpine fir	Grand fir	Spruce Western redcedar hemlock
	thousand board feet						
9.0 - 10.9	343,004	372,085	26,769	142,808	51,261	56,160	64,070 16,834 13,999
11.0 - 12.9	480,071	253,257	73,636	177,214	46,773	86,583	108,439 27,694 6,204
13.0 - 14.9	459,963	148,356	108,563	240,012	21,668	85,397	91,766 13,925 7,536
15.0 - 16.9	466,558	38,374	104,094	249,035	24,430	70,134	67,940 18,177 3,189
17.0 - 18.9	384,406	8,916	121,650	247,737	18,794	56,507	60,449 12,879 18,106
19.0 - 20.9	244,506	8,965	108,156	208,536	2,706	37,057	38,636 10,188 2,499
21.0 - 22.9	178,093	3,197	149,468	188,277	790	23,101	31,571 4,478 1,962
23.0 - 24.9	116,449	684	137,885	155,377	750	8,000	18,781 1,783
25.0 - 26.9	75,442		112,125	160,055		6,174	15,497 3,931
27.0 - 28.9	55,941		75,850	99,405		6,029	12,670 2,872
29+	69,109		220,584	223,163		2,715	17,037 17,725
ALL CLASSES	2,873,542	833,833	1,238,781	2,091,619	167,172	437,856	526,857 130,487
	Whitebark limber pine		Western white pine	Total Soft- wood species	Aspen	Cottonwood	Other hardwoods
9.0 - 10.9	4,140	10,903		1,102,032			
11.0 - 12.9	13,713	21,559		1,295,141	13,637	6,817	4,005
13.0 - 14.9	25,426	34,973		1,237,585	1,575	7,781	662
15.0 - 16.9	19,261	10,025		1,071,218	3,830	5,340	2,635
17.0 - 18.9	19,465	17,029		965,939	4,065	8,359	401
19.0 - 20.9	15,727	13,095		690,071	4,398	5,337	
21.0 - 22.9	7,697	2,251		590,886		1,522	
23.0 - 24.9	3,878	11,836		455,421		620	949
25.0 - 26.9	1,934	1,938		371,096			
27.0 - 28.9	1,358	2,604		256,728	1,979	3,191	5,170
29.0+		19,171		569,504	1,918	20,910	22,828
ALL CLASSES	112,598	145,383		8,611,620	31,401	59,877	8,652
							99,931
							8,711,551

*Also includes a small amount of mountain hemlock.

APPENDIX 2

WOOD PROCESSORS IN WORKING CIRCLE 1

TABLE 125.
Key to tables 126 to 129.

Annual Production

A -	Less than 3,000 MBF
B -	3,000 - 5,000 MBF
C -	5,000 - 10,000 MBF
D -	10,000 - 25,000 MBF
E -	25,000 - 50,000 MBF
F -	Greater than 50,000 MBF

Species Processed

DF	- Douglas-fir
WP	- Western white pine
WRC	- Western redcedar
PP	- Ponderosa pine
LPP	- Lodgepole pine
ES	- Englemann spruce
WF	- White fir
WL	- Western larch
WH	- Western hemlock

Products Manufactured

Dim.	- Dimension
Lbr.	- One-inch boards
Ties	- Railroad crossties

Type of treating plant

P	- pressure
NP	- nonpressure
T	- thermal
NT	- nontreating
CS	- cold soak

Preservatives used

P	- penta
O	- oil born

TABLE 126.
Sawmills in Working Circle 1.

COMPANY	ANNUAL PRODUCTION	SPECIES PROCESSED	PRODUCTS MANUFACTURED
<u>FLATHEAD COUNTY</u>			
<u>Bigfork</u>			
Bigfork Shakemill	A		
Henrik Brosten	A		Portable Sawmill
Lee Eastman Sawmill	A		Dim
<u>Coram</u>			
Valley Wood Products Co., Inc.	A	DF,LLP,ES,WF,WL Cottonwood Inactive	Dim, Lbr, Studs, Timbers, Rough and Surfaced
<u>Columbia Falls</u>			
Custom Sawing	A	DF,PP,LPP ES,WF,WL Cottonwood	Dim, Lbr, Timbers, Studs, Rough
Herzog, E.J.	A		
Johnston, Howard	A		
Louisiana Pacific Corp.	E	WL,LPP,WF	Dim, Surfaced
Plum Creek Lumber Co.	F	DF,ES,LPP,WL WRC,WF,WP,PP WH	Dim, Lbr, Studs, Timbers, Ties, Rough & Surfaced
Stoltze (F.H.) Land & Lumber Co.	E	DF,LPP,ES,WL PP,WP,WRC,WF WH, Cottonwood	Dim, Lbr, Timbers Surfaced
Superior Buildings Co.	D	DF,ES,LPP,WL WP,WRC,WF	Dim, Lbr, Studs, Decking, Flooring Shakes, Studs
Wild Wood Products	A		
Woster, Ed	A		
<u>Kalispell</u>			
Brabender, Jack	A		Portable Sawmill
Forest Products Co.	B	DF,ES,WL,LPP PP,WRC,WP,WF WH, Birch, Cottonwood	Dim, Lbr, Timbers Studs, Lath, Rough and Surfaced
John Galloway	A		Portable Sawmill
Ernest Greig	A		
Kalmont Lumber Co.	C	DF,WP,WRC, PP,LPP,ES,WF,WL, Cottonwood	Dim, Lbr, Timbers Rough and Surfaced
Klinger Lumber Co.	B		
William Lynch Sawmill	A		Portable Sawmill
Montana Lumber & Plywood	B		Studs
Morris Logging & Lumber	B	WP,PP,LPP WL, Cottonwood	Dim, Lbr, Timbers Ties, Studs, Rough

COMPANY	ANNUAL PRODUCTION	SPECIES PROCESSED	PRODUCTS MANUFACTURED
<u>Kalispell</u> (cont'd.)			
Morton Lumber Co.	A	DF,PP,LPP,ES, WF,WL	Dim, Lbr, Timbers Studs, Ties, Rough and Surraced
Allen Sheldon	A		Portable Sawmill
H.E. Simpson Lumber Co.	A		Dim
Jerry Stafford Sawmill	A		Portable Sawmill
Paul Teichman Lath Mill	A		
Turver Mill	A	DF,WP,PP LPP,WF,WL	Dim, Lbr, Timbers Studs, Rough and Surraced
Robert Violet	A		
Gene Wise Sawmill	A		Portable Sawmill
<u>Kila</u>			
Frank Gamma Sawmill	A		
<u>Lakewide</u>			
Roger McKenzie	A		Portable Sawmill
<u>Martin City</u>			
Thomas Foley	A		Portable Sawmill
Frank Uhler	A		
<u>Marion</u>			
C. Worden Hardy	A		
Kinniburgh Brothers	A		Dim
<u>Olney</u>			
American Timber Co.	E	DF,WL,ES,LPP WF	Studs, Surraced, Stud Salvage to 1" x 2" x 8"
<u>Polebridge</u>			
L & S Lumber Co.	A		
<u>West Glacier</u>			
John Dalimata	A		Portable Sawmill
<u>Whitefish</u>			
Stillwater Timber Co.	A		
Strickler-Taylor Lumber Co.	A		Structural finger
LAKE COUNTY			
<u>Arlee</u>			
Scot Crawford	A		Rough boards Dimension

COMPANY	ANNUAL PRODUCTION	SPECIES PROCESSED	PRODUCTS MANUFACTURED
<u>Pablo</u>			
Plum Creek Lumber Co.	F	DF,WP,LPP PP,WRC,WF ES	Dim, Ties, Studs, Timbers, Lbr, Rough and Surraced
<u>Polson</u>			
J & D Lumber			Dim, Lbr, Studs, Rough & Surfaced
LINCOLN COUNTY			
<u>Eureka</u>			
Arnold Brouillette	A		Portable Sawmill
John Beckston	A		
C.M. Eckholt	A		Portable Sawmill
Bill Gould	A	DF,ES,WL Cottonwood Birch, Aspen	Dim, Lbr, Rough
Jack Higle	A		Portable Sawmill
Independence Lumber Co.	A		
Pat Kearney	A		Portable Sawmill
Orvin Larson	A		
D & S Logging	A		Portable Sawmill
McDonald Mill	A	DF,WL,PP,ES WF,LPP	Dim, Lbr, Studs, Ties, Rough, Cedar Posts and Rails Studs
Owens-Hurst Lumber Co.	C	DF,ES,WL,LPP PP,WRC,WF,WH	
Randall Richmond	A		Portable Sawmill
Robert Rieben	A		Portable Sawmill
Jay Stoddard	A		Portable Sawmill
James Warbelis	A		Portable Sawmill
<u>Fortine</u>			
Ksanka Lumber Co.	E	DF,LPP,ES WF,WL	Studs, Ties, Stud Salvage, Surfaced
Robert Quilling	A		
<u>Libby</u>			
Lewis Blackwell	A		
Frank Cooper	A	Dead Timber	Dim, Custom cutting
Alford Manner	A		
St. Regis Paper Co.	F	DF,ES,WH,WP WL,LPP,PP WRC,WF	Dim, Lbr, Timbers Studs, Stractan, Rough and Surraced
<u>Rexford</u>			
Kaufman Lumber	A		Dim, Lbr
Miller Lumber	A		Dim, Lbr
Spring Creek Mill			

COMPANY	ANNUAL PRODUCTION	SPECIES PROCESSED	PRODUCTS MANUFACTURED
<u>Trego</u>			
Leroy Mee	A		
Alvin Meier	A		
<u>Troy</u>			
Rueben Kneller	A		
SANDERS COUNTY			
<u>Heron</u>			
Dettwiler Brothers	A		Portable Sawmill
<u>Paradise</u>			
Norman G. Hermes	A		
<u>Noxon</u>			
Bull River Custom Cutter			Mobile Dimension
<u>Plains</u>			
Lars A. Allestad	A		Portable Sawmill
Carr Sawmill	A		Portable Sawmill
Flodin Lumber Co., Inc.	D	DF,WF,ES,PP LPP,WRC,WP	Dim, Lbr, Timbers, Rough and Surfaced 2 x 4's, Ties
Gary Leighty	Part-time Belsaw		
James W. Nohweder	A		Portable Sawmill
Jim Rohweden	Part-time Belsaw		
<u>Thompson Falls</u>			
National Log Construction Co.	A	LPP,WL	Houselogs
Thompson Falls Lumber Co.	E	DF,ES,WH WP,WL,LPP PP,WRC,WF	Dim, Lbr, Studs Surfaced
Watter Brothers Lumber Co.	A	DF,WP,WRC ES,WF,PP LPP,WL,WH	Dim, Lbr, Timbers Ties, Cut Stock Rough and Surraced
<u>Trout Creek</u>			
Carlson Sawmill	A	DF,PP,LPP WF,WL	Dim, Lbr, Studs, Custom Cut, Rough Portable Sawmill
Larry Craid	A		Studs
Louisiana-Pacific	D	PP,DF,WL WF,LPP	
Vinson Timber Products	A		

TABLE 127.
Post and pole processors in Working Circle 1.

COMPANY	TYPE OF PLANT	PRESERVATIVE USED	PRODUCTS MANUFACTURED
<u>FLATHEAD COUNTY</u>			
<u>Columbia Falls</u>			
Half Moon Post & Pole	T-NP	P-O	Posts, Poles
Larry's Post & Treating Co.			
<u>Kalispell</u>			
Creston Pole & Post Yard	T-NP	P-O	Posts, Poles Ties
Kalispell Pole & Timber Co.	T-NP	P-O	Posts, Poles, Ties, Timbers Building poles
<u>Whitefish</u>			
Wood H.F. Fence Co.			
<u>LAKE COUNTY</u>			
Flathead Post & Pole	CS-P	P-O	Posts, Poles
<u>LINCOLN COUNTY</u>			
McDonald Mill	Cedar		Cedar Posts & Rails
<u>SANDERS COUNTY</u>			
Pioneer Post & Rails			

TABLE 128.
Plywood and particle board processors in
Working Circle 1.

COMPANY	CAPACITY	PRODUCT MANUFACTURED
<hr/> FLATHEAD COUNTY <hr/>		
<u>Columbia Falls</u>		
Plum Creek Lumber Co.	110 mm sq ft 3/8"	Softwood plywood
Plum Creek Lumber Co.	70 mm sq ft 3/4"	Medium density fiberboard
<u>Kalispell</u>		
Plum Creek Lumber Co.	124 mm sq ft 3/8"	Softwood plywood
Plum Creek Lumber Co.	103 mm sq ft	Softwood veneer
<hr/> LINCOLN COUNTY <hr/>		
<u>Libby</u>		
St. Regis Paper Co.	80 mm sq ft 3/8"	Softwood plywood

TABLE 129.
Log home manufacturers in Working Circle 1.

COMPANY	AVERAGE NUMBER OF HOMES ANNUALLY	SPECIES PROCESSED	TYPE OF LOG HOME
<hr/> FLATHEAD COUNTY <hr/>			
<u>Bigfork</u>			
Curtis & Curtis Construction	6	Dead LPP	Tongue and groove and lapped
Man Log Homes	15	Dead	Swedish cove
<hr/> SANDERS COUNTY <hr/>			
<u>Thompson Falls</u>			
National Log Const. Co.	60 - 100	Green LPP	Lathe turned tongue and groove

APPENDIX 3

LOCATION RECORD SHEET AND TREE DATA SHEET

LOCATION RECORD SHEET																									STATE		1 2 5 0		COUNTY					3 4 5 0 5 3		LOCATION					6 7 8 2 3 6																																																																																																																																																																													
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<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center;">SURVEY UNIT</td> <td colspan="2" style="text-align: center;">REGION/ NATIONAL FOREST</td> <td colspan="2" style="text-align: center;">WORKING CIRCLE</td> <td colspan="2" style="text-align: center;">U.T.M. NORTHING COORDINATES</td> <td colspan="2" style="text-align: center;">U.T.M. EASTING COORDINATES</td> <td colspan="2" style="text-align: center;">SAMPLE AND</td> <td colspan="2" style="text-align: center;">DATE OF SURVEY</td> <td colspan="2" style="text-align: center;">ELEVATION</td> <td colspan="2" style="text-align: center;">PI LAND USE</td> <td colspan="2" style="text-align: center;">GROUND LAND USE</td> <td colspan="2" style="text-align: center;">USE TREND</td> <td colspan="2" style="text-align: center;">OWNER</td> <td colspan="2" style="text-align: center;">STAND ORIGIN</td> <td colspan="2" style="text-align: center;">ASPECT/SLOPE PHYSIO CLASS</td> <td colspan="2" style="text-align: center;">STAND CLASSIFICATION</td> <td colspan="2" style="text-align: center;">SEED SOURCE</td> <td colspan="2" style="text-align: center;">FOREST TYPE</td> <td colspan="2" style="text-align: center;">GRID ZONE</td> <td colspan="2" style="text-align: center;">FUEL TYPE</td> <td colspan="2" style="text-align: center;">STAND SIZE</td> <td colspan="2" style="text-align: center;">TRHT 1</td> <td colspan="2" style="text-align: center;">TRHT 2</td> <td colspan="2" style="text-align: center;">TRHT 3</td> <td colspan="2" style="text-align: center;">RANGE</td> </tr> <tr> <td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td><td>33</td><td>34</td><td>35</td><td>36</td><td>37</td><td>38</td><td>39</td><td>40</td><td>41</td><td>42</td><td>43</td><td>44</td><td>45</td><td>46</td><td>47</td><td>48</td><td>49</td><td>50</td><td>51</td><td>52</td><td>53</td><td>54</td><td>55</td><td>56</td><td>57</td><td>58</td><td>59</td><td>60</td><td>61</td><td>62</td><td>63</td><td>64</td> </tr> <tr> <td>-</td><td>1</td><td>1</td><td>0</td><td>9</td><td>9</td><td>0</td><td>1</td><td>5</td><td>3</td><td>7</td><td>5</td><td>0</td><td>5</td><td>7</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>7</td><td>7</td><td>0</td><td>2</td><td>0</td><td>2</td><td>3</td><td>2</td><td>0</td><td>0</td><td>0</td><td>2</td><td>0</td><td>1</td><td>2</td><td>3</td><td>2</td><td>0</td><td>3</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>																									SURVEY UNIT		REGION/ NATIONAL FOREST		WORKING CIRCLE		U.T.M. NORTHING COORDINATES		U.T.M. EASTING COORDINATES		SAMPLE AND		DATE OF SURVEY		ELEVATION		PI LAND USE		GROUND LAND USE		USE TREND		OWNER		STAND ORIGIN		ASPECT/SLOPE PHYSIO CLASS		STAND CLASSIFICATION		SEED SOURCE		FOREST TYPE		GRID ZONE		FUEL TYPE		STAND SIZE		TRHT 1		TRHT 2		TRHT 3		RANGE		9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	-	1	1	0	9	9	0	1	5	3	7	5	0	5	7	1	0	1	1	0	7	7	0	2	0	2	3	2	0	0	0	2	0	1	2	3	2	0	3	1																	LOCATION INFORMATION																									LOT 23 DEC '77				
SURVEY UNIT		REGION/ NATIONAL FOREST		WORKING CIRCLE		U.T.M. NORTHING COORDINATES		U.T.M. EASTING COORDINATES		SAMPLE AND		DATE OF SURVEY		ELEVATION		PI LAND USE		GROUND LAND USE		USE TREND		OWNER		STAND ORIGIN		ASPECT/SLOPE PHYSIO CLASS		STAND CLASSIFICATION		SEED SOURCE		FOREST TYPE		GRID ZONE		FUEL TYPE		STAND SIZE		TRHT 1		TRHT 2		TRHT 3		RANGE																																																																																																																																																																								
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<p style="text-align: center;">TEN POINT LAYOUT</p>																									REFERENCE POINT										COURSE TO SAMPLE LOCATION FR. RP																																																																																																																																																																																			
																									SP 119										AZ 238° DIST. 970'																																																																																																																																																																																			
																									DBH 19.0" at 4.0'										WITNESS TREES																																																																																																																																																																																			
																									DESCRIPTION The RP is about 40' south of the road and the only white pine in the area.										X-SP 202 DBH 108" AZ 260° DIST. 157'																																																																																																																																																																																			
																																			Y-SP 073 DBH 52" AZ 168° DIST. 63'																																																																																																																																																																																			
GENERAL STATEMENT																									FIELD CREW																																																																																																																																																																																													
ROAD DIRECTIONS, ETC. Take highway 2 west from Troy 1.9 miles and turn left, then go 1.8 miles and turn right. Go 1.6 miles and stop. The RP is on your left.																									ESTIMATOR Gelderman																																																																																																																																																																																													
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FUEL MODEL KEY ITEMS (circle); I, (I); A, (B);
 1, 2; a, b; (1), (2); (a), (b); (aa), (bb).

Map # 78
 Killbrennan Lake

STATE	1	2	COUNTY	3	4	5	LOCATION	6	7	8
	3	0		0	5	3		2	3	6

TREE IDENTIFICATION										TREE MEASUREMENT					TREE CLASSIFICATION										OPTIONS					REMARKS
PLANT NUMBER	TREE NUMBER	AZIMUTH	DISTANCE	TREE HISTORY	SITE TREE CODE	SPECIES	DBH	HEIGHT	10 YEAR RAD. GROWTH	TREE AGE	CR. RATIO	CR. CLASS	REL. CROWN CANOPY POSITION	SURFACE DEFECT	INT. DEFECT	TOT. VOL. LOSS	DANGER/ CAUSING DEATH	TREE COVER CLASS	DEAD CORDS	J. STEMS	MISTLETOE	HABITAT TYPE	10/10, POSIT.	HORIZ. CONF.						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25						
01	01	16	72	30	1	073	309	148	04	200	72	A1	11	99	01	10			3						LOT 23 DEC '77					
01	02	16	80	06	01	95	073	052	05	604	05	85	34	11	99	01	10			3										
01	03	20	53	00	01		073	335	150	04	200	62	41	11	11	22	20			3										
01	04	07	80	04	01		99	001	30	19		02	5				01	10							Birch					
01	05	10	70	04	01		99	002	60	23							71	20							Birch					
01	06	17	90	02	01		073	039	03	404	04	14	A4				71	20		3										
01	07	08	00	05	01		24	200	01			00	8				01	10		3										
01	08	10	10	03	01		24	200	01								01	10		3										
01																		45			53	13	2							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25						
02	01	00	60	04	01	95	202	068	04	113	04	95	34	11	99	01	10			3										
02	02	03	30	02	06		073	193	09	5							66		32						63' present					
02	03	04	72	24	01		073	309	196			42	41	11	99	01	10			3										
02	04	08	72	10	01		073	239	17	101	20	04	2	41	11	11	74	20		3										
02	05	17	71	80	A		073	207	149								44		31						143' Present DBH taken at 5.0'					
02	06	22	51	17	01		073	315	17	204	20	06	2	41	11	11	01	10		3										
02	07	31	60	08	01		073	072	07	604	05	64	3	41	11	99	01	10		3										
02	08	10	60	05	01		24	200	01								01	10		3										
02	09	10	70	05	01		24	200	01								01	10		3										
02	10	11	20	05	01		24	200	01								01	10		3										

MONTANA TREE DATA SHEET

RITE-IN-THE-PAIN

PAGE 1 OF 5

APPENDIX 4

WOODLAND GRAZING DATA SHEET AND A SAMPLE SCS GRAZING GUIDE

Location 182 Crew Long / Metzmaker
 County 53 Date 10/26/77
 Working Circle 1 State Forest _____

Species	Column A Present Percent Composition by Wt.	Column B Present Percent Composition Allowed
DECREASERS: Bluebunch wheatgrass	25	25
ELK Sedge	5	5
SERVICE BERRY	5	5
INCREASERS: Idaho Fescue	5	5
pinegrass	15	15
other forb incr.	5	5
Juniper	5	5
other woody incr.	30	5
ORIGON GRAPE	5	5
INVADERS: SPIREA	5	5
		<u>70</u>
Invaders —	trace	

Percent Composition 100% 70 %
 Condition Class Rating XXXX Good Condition

Guide Sheet Doug. Fir climax Precipitation Zone _____

Crown Density 10-30 30-50 50-70 70+
 Soil Depth Deep and Moderately Deep (20") Shallow and Coarse
 Very Shallow (10")
 Greater Effective Moisture YES NO

REMARKS: _____

PART I. GUIDE FOR DETERMINING FORAGE CONDITION - 20-35 INCH PRECIPITATION ZONE

DECREASERS	INCREASERS	Maximum Percent Dry Weight Produced Annually-Little or No Grazing							INVADERS
		Deep & Moderately Deep Soils (Over 20")			Shallow & Coarse Upland Soils				
		Tree Crown Cover Percent			Tree Crown Cover Percent				
		10-30	30-50	50-70	10-30	30-50	50-70		
Blue wildrye Rough fescue Columbia needlegrass Mountain brome Nodding brome Bluebunch wheatgrass Bearded wheatgrass Western wheatgrass Slender wheatgrass Sticky geranium Stoneseed Serviceberry Snowberry Huckleberry* Chokecherry	Pinegrass	10	d	d	5	10	15	All annuals	
	Prairie junegrass	5	-	-	5	-	-	Goatweed	
	Idaho fescue	15	10	-	20	10	5	Cheatgrass brome	
	Elk sedge	10	15	20	5	10	15	Dandelion	
	Heartleaf arnica	-	5	10	-	10	15	Spotted knapweed	
	Balsamroot	5	-	-	5	-	-	Kentucky bluegrass	
	Lupine	5	-	-	5	-	-	Canada bluegrass	
	Other forb increasers	15	20	20	5	10	10	Timothy	
	Oregon grape*	-	5	5	-	5	10	Thistles	
	Bearberry	-	5	5	-	5	10	Mullein	
	Other woody increasers	5	10	15	5	5	10	Leafy spurge	
								Dalmatian toadflax	
								Houndstongue	

Note: "d" denotes that speclea reacts as a decreaser in the instance indicated.
Tree crown cover percent can be estimated from aerial photos using
Crown Coverage Scale. (Handbook page W-132)
* Decreater with game use.

Note: "d" denotes that species reacts as a decreaser in the instance indicated.

Tree crown cover percent can be estimated from aerial photos using

Crown Coverage Scale. (Handbook page W-132)

* Decreaser with game use.

PART II. GUIDE FOR MAKING RECOMMENDATIONS ON STOCKING

Average Annual Precipitation Inches	PRESENT FORAGE VALUE IN PERCENT OF POTENTIAL											
	75%				50%				25%			
	EXCELLENT				GOOD				FAIR			
	Crown Cover Percent				Crown Cover Percent				Crown Cover Percent			
30-35	.85	.55	.35	.75	.50	.30	.55	.35	.25	.20	.15	
25-29	.70	.45	.25	.60	.40	.25	.40	.25	.20	.10	.10	
20-24	.55	.30	.15	.45	.25	.15	.35	.20	.15	.05	.05	
15-19	.40	.20	.10	.35	.15	.10	.25	.15	.05	.05	-	
10-14	.25	.10	.05	.20	.10	.05	.10	.05	.05	.05	.0	

Areas with above normal effective moisture use $\frac{1}{2}$ to 1 zone higher than precipitation zone where located.

For SHALLOW SOILS use values one half zone lower than precipitation zone where located.

For VERY SHALLOW SOILS use values one zone lower than precipitation zone where located.

All utilization cuts due to adverse accessibility are to be applied to grazing unit after AUM's

are summarized.

APPENDIX 5

DESCRIPTION OF TREATMENT CODES

The purpose of this appendix is to define the stand characteristics which make up each of the fourteen categories. In many cases, a stand may receive more than one treatment code. Under each treatment code description below, there is a list of the other codes which may occur in combination with the one being described.

Code 10: Harvest — high risk

Code 10 includes all commercial, nonvigorous, overmature stands, as well as any merchantable stand which exhibits an unmanageable insect or disease problem.

Lodgepole sawtimber stands which are over 100 years old are automatically included.

Possible combinations: None

Code 11: Harvest — low risk

This is a diverse category which includes the following types of stands:

1. All commercial stands older than 100 years which do not qualify as high risk (they are of relatively better vigor than high risk stands). If such a stand is dominated by shade-tolerant species, it is included here, regardless of age.
2. All commercial lodgepole stands which are 50-100 years old and nonvigorous, and which have not qualified as high risk.
3. Various other stands containing commercial material which are not manageable because of poor tree quality and vigor.

Possible combinations: None

Code 12: Commercial thinning

This category includes stands which are fully stocked to overstocked with Douglas-fir, western larch, ponderosa pine or lodgepole pine, and which meet all of the following characteristics:

1. Would yield commercial sawtimber if thinned.
2. Are less than 100 years old.
3. Are currently growing at less than full potential, but are capable of release.
4. Do not exhibit unmanageable insect or disease problems.

Possible combinations: (12, 13), (12, 13, 22), (12, 22).

Code 13: Overstory removal

Code 13 includes any stand which contains commercial size trees in excess of 1,000 b.f. per acre, and which also meets one of the following conditions:

1. The trees in question are relicts, i.e., not part of the manageable stand component.
2. The trees in question represent the upper story of a two storied stand, but they are inadequately stocked to be treated as a separate management component.

Possible combinations: (13, 22, 33), (12, 13), (12, 13, 22), (13, 33), (13, 22), (13, 22, 23), (13, 20), (13, 20, 22), (13, 20, 23), (13, 20, 22, 23), (13, 23), (13, 21).

Code 20: Precommercial thinning

There are two general types of stands which qualify for precommercial thinning. These are:

1. Seedling and/or sapling stands which contain a manageable component of desirable or acceptable crop trees, but which will suffer growth loss from competition prior to reaching merchantable size, if stocking is not reduced.
2. Sapling to pole-size Douglas-fir, western larch, ponderosa pine or lodgepole pine which meet all of the following characteristics:
 - a. Stand is currently growing at less than full potential because of competition.
 - b. There is a fully stocked, manageable component which is capable of release.
 - c. Thinning would not yield merchantable material, and would not involve the felling of near-merchantable trees.

Possible combinations: (13, 20), (13, 20, 23), (20, 23), (13, 20, 22, 23), (20, 22, 23), (13, 20, 22), (20, 22).

Code 21: Stand conversion

This treatment code automatically implies the need for regeneration, following conversion.

Stands which qualify for this category include all precommercial stands which have unmanageable insect or disease problems. Also included are nonvigorous precommercial stands which would not be capable of release, if thinned. In the case of lodgepole pine, it includes all nonvigorous stands which are older than 50 years.

Seedling and sapling stands which are grossly understocked with crop trees, but which contain a significant stocking of undesirable (excess) trees, are also included under this category.

Possible combinations: (13, 21).

Code 22: Sanitation

This code applies to all crop stands whose health can be improved through intermediate cuttings, i.e., cuttings which reduce the source of the insect or disease problem (not applicable for most defoliating insect problems).

This category does not include stands which are in need of commercial harvest or precommercial stand conversion because of insects or disease, low vigor, or stagnation. It applies only to stands which can be sanitized and managed as a crop stand.

Possible combinations: (13, 22, 33), (22, 33), (12, 13, 22), (12, 22), (13, 22), (13, 22, 23), (22, 23), (13, 20, 22), (20, 22), (13, 20, 22, 23), (20, 22, 23).

Code 23: Regeneration of understocked areas

Code 23 includes all precommercial stands which are inadequately stocked with desirable or acceptable crop trees. The minimum standard for adequate crop tree stocking is 210 trees per acre, with at least 70 percent of the area stocked.

This code by no means implies a particular method of regenerating understocked areas. Under code 23, options may exist for use of existing seed sources, site preparation, planting, direct seeding, or combinations of these methods. In many cases, this treatment code represents situations where the stocking of undesirable excess trees must be reduced prior to supplementing the existing understocked crop stand with additional regeneration. In such cases, this treatment would occur in combination with precommercial thinning (code 20).

It should also be noted that regeneration needs which are associated with stand conversion (code 21) are separate from those under code 23.

Possible combinations: (13, 22, 23), (22, 23), (13, 20, 23), (20, 23), (13, 20, 22, 23), (20, 22, 23), (13, 23).

Code 30: No treatment due to productive condition

Stands in this category are adequately stocked with productive crop trees for timber management purposes. In the case of very young stands, stocking of undesirable (excess) competition is minimal, and should not impact growth rates on crop trees before merchantable size is attained. In the case of large sapling to small sawtimber stands, the crop trees are currently growing at or near full potential for their age and the site, and are expected to continue to do so for several years.

There are no significant insect or disease problems associated with stands in this category, with the possible exception of defoliators which have not affected the manageability of the stand.

Possible combinations: None

Code 32: No treatment — Inoperable¹

¹Not assigned using key. Based on field observations.

This category includes all stands on sites which are considered inoperable, using current, conventional Montana logging systems (does not include balloon or helicopter systems).

Generally, slopes steeper than 80 percent are considered inoperable at the present time. Other inoperable situations include very rocky areas, where road building and logging might be difficult, or an otherwise operable site which has no operable access routes.

Possible combinations: None

Code 33: No treatment — Defer until merchantable

Code 33 includes pole to small sawtimber-size stands whose growth rates could be improved through thinning, but not without the loss of near-merchantable material. Because growth rates and tree quality are acceptable (but not optimal), stands in this category are deferred from treatment until the stand emerges into a size class where commercial treatment options exist. However, stands in this category may qualify for overstory removal (code 13) and/or sanitation (code 22), even though the crop stand has been deferred from thinning. In other words, the "No treatment" label applies only to the main stand component.

Possible combinations: (13, 22, 33), (22, 33), (13, 33).

Code 40: Unknown — Poor crowns, good growth

This is a fairly unique but well-defined category for which the data compiled in the stand treatment analysis does not provide enough information to make a logical decision.

All stands under code 40 possess the following characteristics:

1. Fully stocked Douglas-fir, western larch, or ponderosa pine saplings, poles, or small sawtimber.
2. Growth rates at or near full potential.
3. Poor crown ratios ($\leq 30\%$).
4. No unmanageable insect or disease problems.

The problem in this situation is that the compiled data fails to explain why a stand would have poor crown ratios, but also good growth rates during the last ten (10) years. Have crowns recently become suppressed from competition? In this case, the next ten years' growth might be much lower. Or, has this stand been released during the last ten years? In this case, the crown ratios may be improving, even though they are presently unacceptable.

Because the data summary does not answer the above questions, the treatment opportunities are not logically defined for such a stand.

Possible combinations: None

APPENDIX 6

DATA RELIABILITY

TABLE 130.
Timberland area and associated sampling error
percentages for Working Circle 1.

Item	Softwood Types		Hardwood Types		All Types	
	Acres	Error	Acres	Error	Acres	Error
Commercial timberland	1,560,851	$\pm 1.1\%^*$	19,902	$\pm 48.5\%$	1,580,753	$\pm 1.1\%$
Noncommercial timberland	12,479	± 24.2	1,342	± 30.2	13,821	± 22.1

TABLE 131.
Net volume, net annual growth, and annual mortality on
commercial timberland with associated sampling error
percentages for Working Circle 1.

Item	Softwood Species		Hardwood Species		All Species	
	Volume	Error	Volume	Error	Volume	Error
Volume:						
Growing Stock (thousand cubic feet)	2,735,117	$\pm 3.2\%$	54,798	$\pm 23.1\%$	2,789,915	$\pm 3.2\%$
Sawtimber (MBF Scribner)	8,611,620	± 4.1	99,931	± 31.1	8,711,551	± 4.1
Net Growth:						
Growing stock (thousand cubic feet)	64,128	± 5.4	1,777	± 23.6	65,904	± 5.3
Sawtimber (MBF Scribner)	202,326	± 6.3	6,073	± 50.0	208,398	± 6.2
Mortality:						
Growing stock (thousand cubic feet)	12,788	± 11.1	168	± 73.5	12,956	± 11.0
Sawtimber (MBF Scribner)	34,276	± 14.9	—	—	34,276	± 14.9

* To calculate the confidence interval, multiply 1.1 percent by 1,560,851. In this example, the confidence interval would be 1,560,851 \pm 17,169 acres.

TABLE 132.
Timberland area and associated sampling error
percentages for Flathead County.

Item	Softwood Types Acres Error	Hardwood Types Acres Error	All Types Acres Error
Commercial timberland	578,988 \pm 1.9%	6,758 \pm 75.9%	585,746 \pm 1.8%
Noncommercial timberland	1,918 \pm 43.8	462 \pm 51.5	2,380 \pm 36.7

TABLE 133.
Net volume, net annual growth, and annual mortality on
commercial timberland with associated sampling error
percentages for Flathead County.

Item	Softwood Species Volume Error	Hardwood Species Volume Error	All Species Volume Error
Volume:			
Growing Stock (thousand cubic feet)	1,102,733 \pm 5.2%	20,517 \pm 31.9%	1,123,251 \pm 5.1%
Sawtimber (MBF Scribner)	3,492,681 \pm 6.7	26,197 \pm 39.9	3,518,878 \pm 6.7
Net Growth:			
Growing stock (thousand cubic feet)	24,792 \pm 9.0	757 \pm 36.1	25,550 \pm 8.7
Sawtimber (MBF Scribner)	79,570 \pm 10.1	1,696 \pm 80.3	81,266 \pm 10.0
Mortality:			
Growing stock (thousand cubic feet)	5,563 \pm 17.5	97 \pm 97.1	5,661 \pm 17.3
Sawtimber (MBF Scribner)	15,217 \pm 23.9	—	15,217 \pm 23.9

TABLE 134.
Timberland area and associated sampling error
percentages for Lake County.

Item	Softwood Types Acres Error	Hardwood Types Acres Error	All Types Acres Error
Commercial timberland	168,733 \pm 4.5%	3,853 \pm 100.0%	172,586 \pm 4.8%
Noncommercial timberland	1,883 \pm 94.3	122 \pm 100.0	2,006 \pm 88.8

TABLE 135.
Net volume, net annual growth, and annual mortality on
commercial timberland with associated sampling error
percentages for Lake County.

Item	Softwood Species Volume Error	Hardwood Species Volume Error	All Species Volume Error
Volume:			
Growing Stock (thousand cubic feet)	274,637 \pm 10.0%	7,725 \pm 62.3%	282,362 \pm 9.8%
Sawtimber (MBF Scribner)	898,495 \pm 11.3	21,216 \pm 74.5	919,711 \pm 11.1
Net Growth:			
Growing stock (thousand cubic feet)	6,356 \pm 17.2	207 \pm 62.7	6,562 \pm 16.8
Sawtimber (MBF Scribner)	21,376 \pm 19.4	1,092 \pm 100.0	22,468 \pm 19.1
Mortality:			
Growing stock (thousand cubic feet)	1,261 \pm 29.0	— —	1,261 \pm 29.0
Sawtimber (MBF Scribner)	3,551 \pm 34.7	— —	3,551 \pm 34.7

TABLE 136.
Timberland area and associated sampling error
percentages for Lincoln County.

Item	Softwood Types		Hardwood Types		All Types	
	Acres	Error	Acres	Error	Acres	Error
Commercial timberland	481,332	$\pm 2.0\%$	3,989	$\pm 100.0\%$	485,321	$\pm 2.0\%$
Noncommercial timberland	2,782	± 33.4	511	± 49.0	3,292	± 20.2

TABLE 137.
Net volume, net annual growth, and annual mortality on
commercial timberland with associated sampling error
percentages for Lincoln County.

Item	Softwood Species		Hardwood Species		All Species	
	Volume	Error	Volume	Error	Volume	Error
Volume:						
Growing Stock (thousand cubic feet)	841,236	$\pm 5.8\%$	16,469	$\pm 44.2\%$	857,705	$\pm 5.7\%$
Sawtimber (MBF Scribner)	2,668,578	± 7.5	20,865	± 49.9	2,689,443	± 7.5
Net Growth:						
Growing stock (thousand cubic feet)	20,074	± 9.8	587	± 45.7	20,661	± 9.5
Sawtimber (MBF Scribner)	61,684	± 11.0	1,259	± 86.1	62,943	± 10.8
Mortality:						
Growing stock (thousand cubic feet)	3,845	± 21.0	70	± 100.0	3,915	± 20.7
Sawtimber (MBF Scribner)	10,034	± 29.5	—	—	10,034	± 29.5

TABLE 138.
Timberland area and associated sampling error
percentages for Sanders County.

Item	Softwood Types		Hardwood Types		All Types	
	Acres	Error	Acres	Error	Acres	Error
Commercial timberland	331,798	$\pm 2.9\%$	5,302	$\pm 100.0\%$	337,101	$\pm 2.9\%$
Noncommercial timberland	5,896	± 39.5	247	± 70.4	6,144	± 38.0

TABLE 139.
Net volume, net annual growth, and annual mortality on
commercial timberland with associated sampling error
percentages for Sanders County.

Item	Softwood Species		Hardwood Species		All Species	
	Volume	Error	Volume	Error	Volume	Error
Volume:						
Growing Stock (thousand cubic feet)	516,510	$\pm 8.0\%$	10,087	$\pm 64.5\%$	526,598	$\pm 7.9\%$
Sawtimber (MBF Scribner)	1,551,867	± 9.6	31,653	± 71.5	1,583,520	± 9.5
Net Growth:						
Growing stock (thousand cubic feet)	12,906	± 12.3	226	± 54.2	13,132	± 12.2
Sawtimber (MBF Scribner)	39,696	± 14.9	2,025	± 100.0	41,721	± 14.7
Mortality:						
Growing stock (thousand cubic feet)	2,119	± 26.1	—	—	2,119	± 26.1
Sawtimber (MBF Scribner)	5,474	± 31.6	—	—	5,474	± 31.6

APPENDIX 7

GLOSSARY

Acceptable tree

Growing-stock tree of commercial species that does not qualify as a desirable tree.

Access

The degree to which the range will be utilized. The factors affecting grazability are slope, miles to the nearest stream, trails and roads in the area, water developments, brush, slash, rocks and mechanical barriers.

Accretion

Annual increase in net volume of trees in a size class, and the increase in net volume of trees after reaching a measured size class during the year.

Allowable cut

The volume of timber that would be cut on commercial forest land during a given period under specified management plans for sustained production, such as those in effect on national forests.

Animal unit

One mature (1,000 pound) cow with or without an unweaned calf, or the equivalent.

Animal unit month

The amount of forage required by an animal unit for one month.

Area condition class

A classification of commercial forest land based upon stocking by desirable trees and other conditions affecting current and prospective timber growth.

Basal area

A measure of square feet of space occupied by the stem of a tree. This measurement is made at breast height.

Basal area factor

The basal or stem area per unit of stand area for a given angle for each tree intercepted from a given point.

Bureau of Land Management lands

Federal land administered by the USDI Bureau of Land Management.

Census water

Water areas of more than 40 acres and water courses more than 1/8-mile wide.

Climax series

A group of habitat types that at climax will be dominated by the same tree species.

Commercial forest land

Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as productive forest land have the capability of producing in excess of 20 ft³/acre/year of industrial wood under management. Currently inaccessible and inoperable areas are included, except where the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future.)

Commercial thinning

A thinning in which the cut trees are large enough to be removed and utilized, regardless of whether their sale offsets the cost of the thinning.

Condition class

A method of expressing the general health of the range by comparing the expected percentage of the climax compositions contributed by each species to the actual composition. No invaders (plants present only because of a disturbance, such as grazing) are counted and only the amount of increasers (plants that increase under grazing pressure) that would be present at climax are included. All of the decreasers (plants that decrease under grazing pressure) are counted.

County and municipal lands

Lands owned by counties and local public agencies or municipalities, or lands leased to these governmental units for 50 years or more.

Crown class

A classification of trees based on dominance in relation to adjacent trees in the stand as indicated by crown development and amount of light received from above and the sides.

Crown density

The percentage of the forest floor that is covered by tree crowns. Forest land with greater than 70 percent crown density is considered to have no range value for livestock.

Cull

Portions of a tree that are unusable for industrial wood products because of rot, form, or other defect.

Decreaser (decreasing range plant)

Plants which decrease under heavy grazing pressure. These are usually the more palatable plants and the ones that the livestock prefer to eat.

Diameter breast height (d.b.h.)

The diameter of a tree at a point 4 1/2 feet above the ground on the tree's uphill side. Height of d.b.h. may vary on abnormally formed trees.

Desirable tree

Live noncull trees of commercial species are divided into two classes: desirable and acceptable. For a tree to be desirable it must be free from disease, of good form, potentially not more than 10 percent defect of disease or fire scar, of good vigor, and not excessively limby if

sawtimber. A tree will be considered to have good vigor if it has 40 percent or more crown (exception: ponderosa pine, and aspen may have only 30 percent crown to be classed as desirable). It is the kind of tree that would be favored in cultural operations or featured in management in under rotation-age stands. Mature trees (over rotation age) of commercial size with less than 20 percent defect and expected to live 10 years are low-risk trees and may also be classed as desirable trees. A species which is not adapted to the site should be classified as sound cull.

Diameter classes

A classification of trees based on diameter outside bark, measured at breast height (4 1/2 feet above the ground). Note: d.b.h. is the common abbreviation for diameter at breast height. Two-inch diameter classes are commonly used in Forest Survey, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h., inclusive.)

Farmer-rancher lands

Lands owned by individuals with a minimum of 40 acres.

Fixed radius plot

For this inventory a 1/300-acre (6.8-foot radius), circular plot, located at each sample point on which live trees up to 4.99 inches d.b.h. are tallied.

Forest industry lands

Lands owned by companies or individuals operating wood-using plants.

Forest land

Land at least 16.7 percent stocked by forest trees, or formerly having such tree cover, and not currently developed for nonforest use. Forest land does not include land currently developed for nonforest uses such as urban or thickly settled residential or resort areas, city parks, orchards, improved roads, or pasture lands improved by such measures as seeding or irrigation. The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must be at least 120 feet wide to qualify as forest land. Unimproved roads, trails, streams, and clearings in forest areas are classed as forest land if they are less than 120 feet wide.

Forest types

A classification of forest land based upon the dominant species forming a plurality of stocking based on area occupied in the present tree cover.

Fish, Wildlife and Parks land

Land administered by the Montana Department of Fish, Wildlife and Parks.

Grazability

The degree to which the range will be utilized. The factors affecting grazability are slope, miles to the nearest stream, trails and roads in the area, water developments, brush, slash, rocks and mechanical barriers.

Gross growth

Annual increase in net volume of trees in the absence of cutting and mortality. It includes ingrowth and accretion.

Growing-stock trees

Sawtimber trees, pole timber trees, saplings, and seedlings; that is, all live trees except cull trees.

Growing stock volume

Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top (of central stem) outside bark. Net volume equals gross volume less deduction for rot and missing bole sections.

Habitat type

An aggregation of all land areas potentially capable of producing similar plant communities at climax.

Hardwoods

Dicotyledonous trees, usually board-leaved and deciduous.

Increaser (increasing range plant)

Plants which increase under heavy grazing pressure. These are usually less palatable plants.

Indian lands

Tribal lands held in fee by the federal government, but administered for Indian tribal groups and Indian trust allotments.

Ingrowth

The number or net volume of trees that grow large enough during a specified year to qualify as saplings, pole timber, or sawtimber. The measurement is at the size of entry into the size class.

Inoperable stand

Any stand on a site that is considered inoperable using current, conventional Montana logging systems (does not include balloon or helicopter systems).

Invader (invading range plant)

Plants that are not part of the climax cover but which invade under heavy grazing pressure. Few invaders are preferred by livestock and many are worthless.

Land use influence zones

Zones delineated around areas or regions where it is likely that other nontimber uses or environmental constraints would have an impact on availability of timber.

Mean annual increment

A measure of the volume of wood, in cubic feet, produced on 1 acre during one year. Forest Survey minimum standard for commercial forest land is the ability to produce 20 ft³/acre/year.

Miscellaneous federal

Federal lands other than national forest lands, lands administered by the USDI Bureau of Land Management, or Indian lands.

Mortality

Number of sound-wood volume of growing stock trees dying from natural causes during a specified period.

Mortality tree

A tree of commercial species, 5.0 inches d.b.h. or larger, standing or down, that has died within the past five years and was not a cull tree at the time of death.

National forest land

Federal lands which have been designated by executive order or statute as national forests or purchase units and other lands under the administration of the USDA Forest Service, including experimental areas.

Net annual growth

The increase in net volume of a specified size class for a specific year. (Note: Components of net annual growth include the increment in net volume of trees at the beginning of the specific year surviving to its end, plus the net volume of trees reaching the size class during the year, minus the net volume of trees that died during the year, minus the net volume of trees that became rough or rotten trees during the year.) Net growth figures in this publication, when expressed as $\text{ft}^3/\text{acre}/\text{year}$ of growing stock, are for all live growing stock trees 5.0 inches d.b.h. and larger.

Net volume

The gross volume of a tree less deductions for rot, sweep, or other defect affecting use for wood products.

Noncommercial forest land

Unproductive forest land incapable of yielding crops of wood because of adverse site conditions, and productive forest land withdrawn from commercial timber use through statute or administrative regulations.

Noncommercial species

Tree species of typically small size, poor form, or inferior quality which normally do not develop into trees suitable for industrial wood products.

Nonforest land

Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses. It includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width, and adjoining clearings, powerline clearings of any width, and 1 to 40 acres of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide, and clearings, etc., more than 1 acre in size to qualify as nonforest land.

Nonsalvable dead

Dead trees 5.0 inches d.b.h. and larger, standing and down, and less than 50 percent sound on a cubic-foot basis.

Firm rotten: Tree is less than 50 percent sound on a cubic-foot basis. More than half the total volume loss is due to rot and less than half is due

to such defects as excessive sweep and crook. Tree or potential product sections are firm enough to hold together if handled.

Crumbly rotten: Tree is less than 50 percent sound on a cubic-foot basis. More than half the total volume loss is due to rot and less than half is due to such defects as excessive sweep and crook. Tree or potential product sections will not hold together if handled.

Nonstockable

Areas of forest land not capable of supporting seedlings of commercial species because of the presence of rock, water, roads, etc.

Nonstocked land

Commercial forest land less than 16.7 percent stocked with growing stock trees.

Old-growth sawtimber stands

Sawtimber stands in which 50 percent or more of the area is occupied by old-growth sawtimber trees.

Old-growth sawtimber trees

Trees that are at least 100 years old.

Other private corporate

Land owned by corporations not in the forest industry.

Other private individual

Lands smaller than 40 acres owned by individuals.

Other state lands

State land other than state forests, land board, and Fish, Wildlife and Parks lands.

Pole timber stands

Stands at least 16.7 percent stocked with growing stock trees of which 50 percent or more of this stocking is in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Poletimber trees

Trees at least 5.0 inches in diameter at breast height but smaller than 9.0 inches for softwoods and 11.0 inches for hardwoods.

Potential growth (or yield capability)

The mean annual increment of growing stock attainable in fully stocked natural stands at the age of culmination of mean annual increment. When expressed in cubic feet of growing stock, unless specified otherwise, the volume figure includes all surviving live trees 1.0 inches d.b.h. and larger for most tree species.

Precommercial thinning

A thinning in which the cut trees are too small to be removed and utilized.

Productive-reserved forest land

Forest land sufficiently productive to qualify as commercial forest land, but withdrawn from timber utilization through statute, administrative designation, or exclusive use for Christmas-tree production.

Rotation

The period of years between establishment of a stand of timber and the time when it is considered ready for cutting and regeneration.

Rotten trees

Live trees of commercial species that do not contain at least one 12-foot saw log or two noncontiguous saw logs, each 8 feet long or longer, now or prospectively, and/or do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees

(1) Live trees of commercial species that do not contain at least one 12-foot saw log or two noncontiguous saw logs, each 8 feet long or longer, now or prospectively, and/or do not meet regional specifications for freedom from defect primarily because of roughness or poor form.

(2) All live trees of noncommercial species.

Salvable dead

Standing and down dead trees 5.0 inches d.b.h. and larger and more than 50 percent sound on a cubic-foot basis.

No defect: Tree has no rot, and no defect such as excessive sweep and crook.

Defect-mostly physical: Tree is more than 50 percent sound on a cubic-foot basis. Less than half the total volume loss is due to rot and more than half is due to such defects as excessive sweep and crook.

Defect-mostly rot: Tree is more than 50 percent sound on a cubic-foot basis. More than half the total volume loss is due to rot and less than half is due to such defects as excessive sweep and crook. Tree or potential product sections are firm enough to hold together if handled.

Sanitation

Improving the health of a stand through intermediate cuttings which reduce the source of the insect or disease problem.

Saplings

Trees 1.0 inches to 4.0 inches in diameter at breast height.

Saw log

A section of a tree stem of sufficient size to yield commercial-size dimension lumber.

Sawtimber stands

Stands at least 16.7 percent stocked with growing stock trees, with half or

more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Sawtimber trees

Softwood trees which are 9.0 inches and larger and hardwood trees which are 11.0 inches and larger in diameter at breast height.

Sawtimber volume

Net volume in board feet of sawtimber trees of commercial species. Net volume equals gross volume less deduction for rot, sweep, crook, and other defects that affect use for lumber.

Scribner Rule

The common board-foot log rule used in determining volume of sawtimber in the western states.

Seedlings

Live trees less than 1.0 inch in diameter at breast height.

Seedling-sapling stands

Stands at least 16.7 percent stocked with growing stock trees in which more than half of the stocking is saplings and/or seedlings.

Site Class

A classification of forest land in terms of inherent capacity to grow crops of industrial wood. Site classifications are based upon the mean annual growth of growing stock (not including thinnings) attainable in fully stocked stands at culmination of mean annual growth. Height-age relationships are usually used as indicators of the specified volume-site class.

Site index class

A measure of site productivity based upon the height of trees at a given base age. Site index classes are height classes represented by a graphed curve of height over age for each class.

Softwoods

Coniferous trees, usually evergreen, having needle or scale-like leaves.

Stand density

A quantitative measure of a stand in terms of square feet of basal area, number of trees, or volume per acre. It reflects the degree of crowding of stems within the area.

Stand-size class

A classification of forest land based on the class of growing stock trees on the area; that is, sawtimber, pole timber, or seedlings and saplings. (Note: Only those trees that contribute to no more than 16 percent of stocking at a plot point, based upon a 10-point location, will be considered in determining stand-size class.)

State forest

Lands managed cooperatively by the Forestry Division and the State Land board.

State forest land

State-owned land that is principally valuable for forest and watershed cover that is classified as forest and administered by the Department of State Lands Forestry Division.

State grazing land

State-owned land that is principally valuable for forage production, that is classified as grazing, and is administered by the Department of State Lands.

Stocking

Stocking is an effort to express the extent to which growing space is effectively utilized by present or potential growing-stock trees or commercial species. "Percent of stocking" is synonymous with "percentage of growing space occupied" and means the ratio of actual stocking to full stocking for comparable sites and stands. Basal area is used as a basis for measuring stocking.

"Stocking percentages" express current area occupancy in relation to specified standards for full stocking based on number, size, and spacing of trees considered necessary to fully utilize the forest land.

Full utilization of the site is assumed to occur over a range of basal area. As an interim guide, 60 percent of the normal yield table values has been used to establish the lower limit of this range, which represents full site occupancy. This is called 100 percent stocking. The upper limit of full stocking has been set at 132 percent. Sites with less than 100 percent stocking represent understocking with less than full site occupancy. Over-stocking is characterized by sites that are over 132 percent stocked.

Tree class

A classification assigned to each live tree based on such physical characteristics as surface and internal defects, relative pole length, crown ratio and position, and damage sustained by the tree. (See also the definitions for "desirable tree," "acceptable tree," "rough tree," and "rotten tree.")

Tree size class

A classification of trees primarily according to diameter at breast height outside bark, including sawtimber trees, pole timber trees, saplings, and seedlings.

Unproductive forest land

Forest land incapable of producing 20 cubic feet per acre of industrial wood under natural conditions because of adverse site conditions. (Note: Adverse conditions include sterile soils, dry climate, poor drainage, high elevation, steepness, and rockiness.)

Variable radius plot

A plot on which a predetermined critical angle is projected from a central point and swept in a full circle to determine the basal area, tree count, and volume per unit of area. The radius of this plot is a function of tree basal area and is, therefore, variable.

Young-growth sawtimber stands

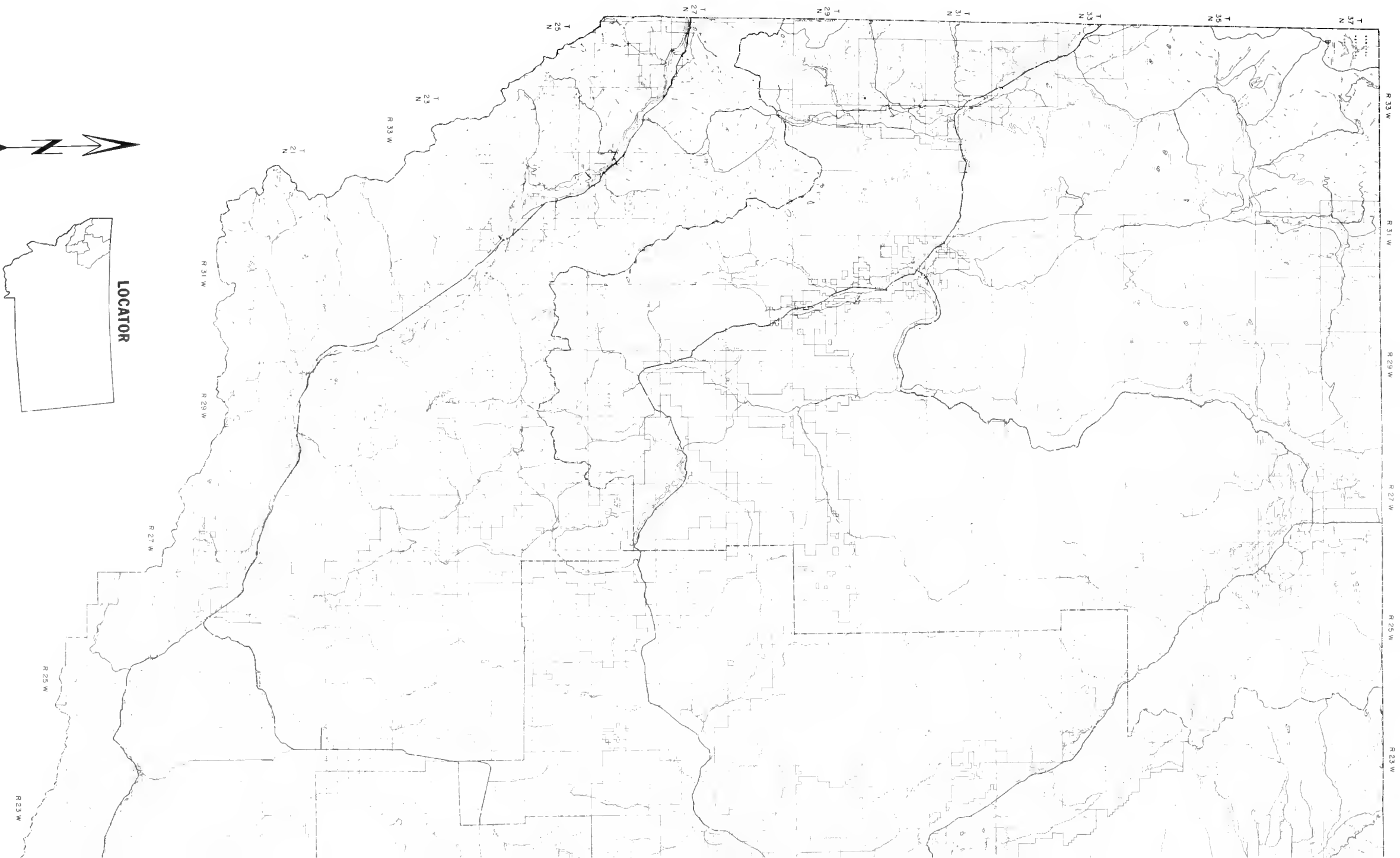
Sawtimber stands in which 50 percent or more of the stand is occupied by young-growth sawtimber trees.

Young-growth sawtimber trees

Sawtimber trees less than 100 years old.



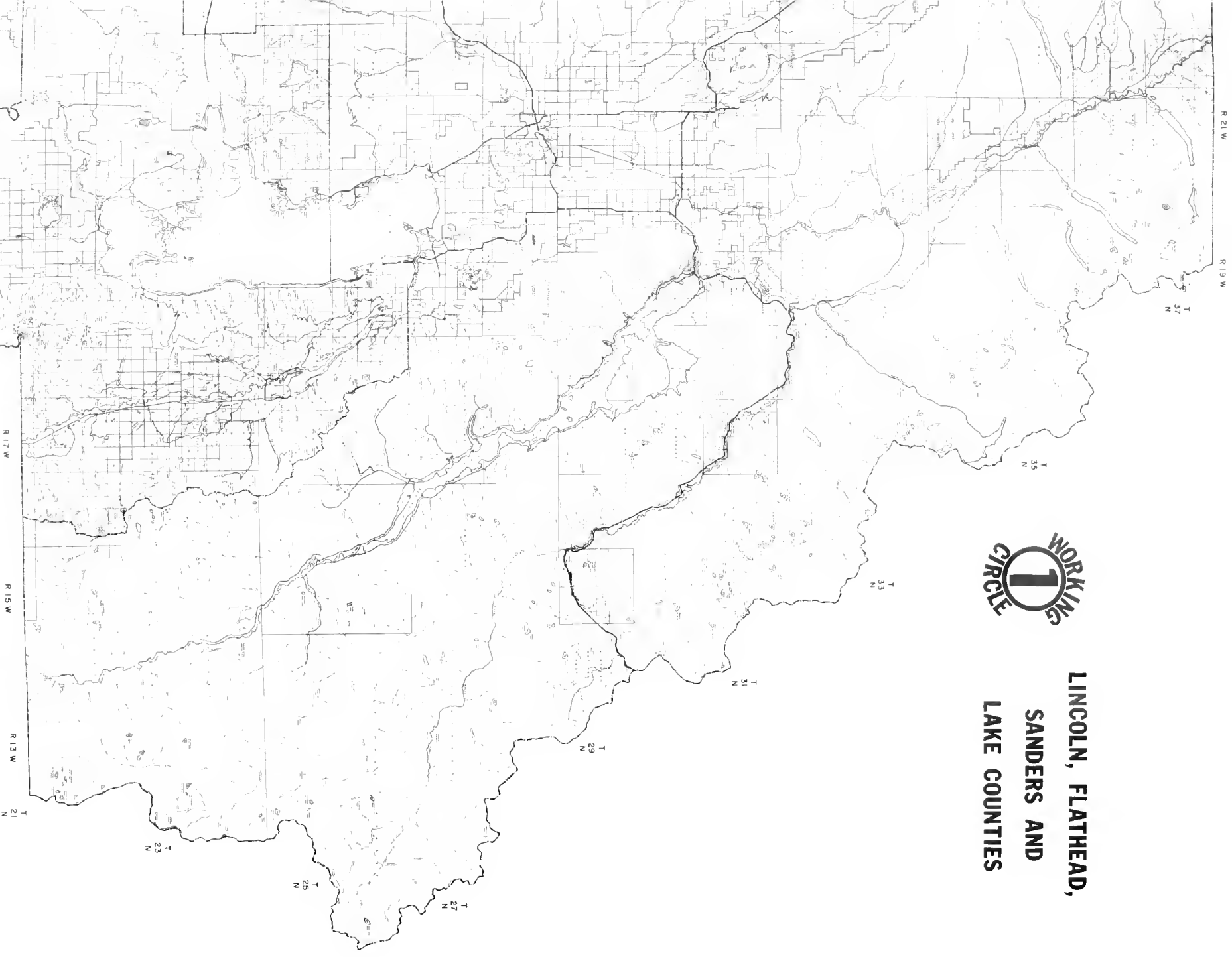
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